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EXTERIOR GESTATION, PRIMITIVE SLEEP, ENURESIS AND ASTHMA: A STUDY IN ÆTIOLOGY.[1] PART I.

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If we wish to understand events occurring in the first year of human life we must view them as in a rapidly moving cinematographic film recapitulating perhaps a million years of evolution. In this brief period there has been created the miracle of a thinking being, able to see, converse and understand. A cardinal feature of this extraordinary sequence is that its form has not been changed for hundreds of thousands, if not millions, of years. The baby still matures on a preformed plan much as a bud becomes a flower or a chrysalis turns into a butterfly.

Thus, in order to appreciate the problems involving a harassed mother with a bed-wetting child (or a harassed physician endeavouring to treat him), it is necessary mentally to retrace our evolutionary footsteps into those dim ages when man had to place a limit to the period for gestation within the womb, and to create exterior gestation relying on primitive or "fossil" sleep as a barrier to infringements by the outer world.

[1] Delivered to the Brisbane Children's Hospital Clinical Society, November 19, 1957.

Definitions and Ætiology.

Enuresis may be defined as the repeated involuntary discharge of urine in sleep after the third year of life (the age limit is arbitrary as a minority of normal children may not become "dry" until the fourth year). The term "essential enuresis" is applied to those cases which are not due to congenital or acquired disease of the nervous or urino-genital system. Approximately 10% of all cases are due to an organic cause. These have been excluded from the series discussed in this paper.

The ætiology of enuresis is extremely confusing. Surgeons, physicians, psychoanalysts, psychiatrists and physiologists have delved into its mysteries. Many ingenious hypotheses and treatments have been suggested and recommended, ranging from the purely organic to the wholly psychological or entirely physiological. Gerard (1939), reviewing the literature, says: "Data offered in support of the theories are frugal and confusing and one is led to believe that our real knowledge concerning the cause of the symptom is in reverse proportion to the frequency of its occurrence." As comprehensive outlines of the existing theories concerning the ætiology of enuresis are already available, no purpose would be served by recapitulation.

Since research on enuresis necessitates treatment, an opportunity is presented of checking at first hand both the ætiology and therapy. In this connexion a paper by Crosby (1950) on the results of electrical stimulation was opportune as it described a method of waking the patient at frequent intervals. This gave scope for observation of the times at which bed-wetting occurred. Significantly, it revealed the difficulty of waking the average enuretic. Success in therapy was early apparent and promised a quick solution to our problems, but enuresis cannot be cured by the simple conditioning of a reflex activity. Ninety-eight patients received this form of treatment. Although many successes occurred, pitfalls were numerous and relapses frequent. Furthermore, it was difficult to avoid psychological hazards (Bostock and Shackleton, 1957). The findings implicated not merely a psychological angle in ætiology but also the depth of sleep.

With the assistance of my colleagues, Dr. J. P. Eckert and Dr. D. H. Ash, several series of patients were treated by other means. (i) By the giving of placebos together with psychological reassurance; (ii) by the exhibition of sleep lightening drugs such as amphetamine or ephedrine; (iii) by the use of "tranquillizing" drugs ("Largactil" and "Meratran") to offset any factor of "nervousness", undue suggestibility or emotional conflict; (iv) by the carrying out of bladder training in order to increase bladder control; (v) by the use of "Pamine" (methscopolamine bromide); (vi) by the dispensing of an antihistamine; (vii) by the use of glandular therapy—extract of thyroid and pituitary snuff. The results were not spectacular. Whilst many patients were relieved, there were numerous failures and relapses (Bostock and Eckert, 1957).

A significant finding was related to pants-wetting, often regarded as a variant of enuresis; but pants-wetting is not enuresis; a different ætiology is probable. In our series methscopolamine ("Pamine") proved a specific remedy for pants-wetting, although it rarely relieved essential enuresis (Bostock and Eckert, 1957). This observation is important, since it limits the timing of enuresis to the period when the child is asleep. Full awakening of the child, even if assisted by drugs, was surprisingly difficult.

During the six years of investigation, constant efforts have been made to find correlations. The presence of an hereditary basis, spina bifida, hirsuties, eye colouring or physical types, etc., have been explored. All are inconstant.

Despite an unbiased approach and an optimistic management of cases, the results are disappointing.

A puzzling ætiological jigsaw exists, the solution of which depends on our finding a missing piece. A possible explanation appears to be a link to dovetail sleep more accurately into an enuresis syndrome. Is enuresis not a disease entity *sui generis* but a mere symptom indicative of influences affecting sleep maturation? As an illustration of this viewpoint our study of asthma may be cited, which shows that it can be understood if the primitive cry language is aligned with subsequent development of the asthmatic attack. Interference with the routine of living in the first months of life alters the normal cry rhythm and lays the foundation for the bizarre and persistent symptomatology of asthma (Bostock, 1956). In other words, a problem in asthma is solved if the symptoms are visualized in a perspective which includes infancy and evolution.

In the matter of enuresis, correlation showed the consistent occurrence of early preoccupation by the parent on training techniques and difficulty in awakening the child (Bostock and Shackleton, 1951, 1952, 1956). Slowly there emerged the concept of a primitive sleep state deepened by outside interference. We were witnessing, in enuresis, its hang-over into childhood, thus accounting for the voiding of urine as in infancy.

The answer to such a hypothesis must depend on observation of the sleep patterns of the enuretic and on an understanding of the evolutionary processes underlying the sleep mechanism. Attention must wander from the bed-wetter of today to his predecessor in the haze of prehistory before beds were invented. Such a study does not present insuperable difficulties.

Sleep and Enuresis.

Literature on the relation of the depth of sleep to enuresis is scanty. Trousseau (1870) referred to the frequently occurring deep sleep of enuretics; Cameron (1946) suggested that it was associated with ketosis; Strom-Olsen (1950) noted prolonged and heavy sleeping by adult enuretics; Hodge and Hutchings (1952) cited the frequency of heavy or very deep sleep in their cases; Roland (1954) noted unusually deep sleep in 74·5% of his 51 cases. On the other hand, Campbell (1954) considered that sleep *per se* had no relation to enuresis; Braithwaite (1955) reported 68% of heavy sleepers among his 273 enuretic children, whereas only 23% of 500 unselected non-enuretic children were difficult to awake. It seems to have been assumed that depth of sleep is intangible; that some enuretics were deep sleepers, but not all; that in any case the symptom of bed wetting which occurred in sleep is not likely to be produced by sleep itself, but to something else, such as defective bladders, heredity, emotional conflicts, anatomical defects, a diathesis etc. Furthermore, sleep is a negation of action, and its inwardness is therefore not observable. Perhaps this explains why, as Illingworth (1953) has pointed out, little has been written about it. In a search through the last 50 volumes of the *Quarterly Cumulative Index Medicus*, he was able to find only 18 papers (four British and one American) dealing with sleep problems. The paucity is highlighted by comparison with the 53 papers on the comparatively unimportant subject of gargoylism appearing in the last 20 volumes.

Observation is certainly difficult. Not merely is objective standardization of awakability dependent upon personal opinion, but also parents are not in the habit of waking their children unless necessary. In one particular we were fortunate. The mothers of enuretics often try to wake the child in order to obtain a dry bed, and in the commotion see the effects of their noisy attempts on the non-enuretic brothers and sisters (often in the same room or even in the same bed). There is therefore the possibility of a control series.

The various methods used to waken children can be grouped in an ascending scale of stimulation. Table I shows the number of children among 19 enuretics and 42 non-enuretic siblings who were wakened by certain tabulated procedures. It will be seen that there is strong evidence of discrepancy in the arousal stimulus between enuretics and non-enuretics. Only three of the former could be awakened by switching on the light in contrast to 24 of the latter. The major procedures of standing up and shaking or of shaking alone were much more effective in the non-enuretic.

At this stage it became obvious that our concept of a sharp dividing line between waking and sleeping needed revision. There was difficulty in deciding when the sleeper awakes—often he is "half" awake. Another series of cases, differentiating between "stirring" (half awake) and fully awake was therefore observed. The results are presented in Table II, concerning 26 consecutive enuretics and 35 consecutive non-enuretic siblings. As a check each mother was interrogated by both myself and the social worker. Doubtful histories were disregarded.

The results indicate that there is a significant tendency for the enuretic children to be awakened with more difficulty than their non-enuretic brothers and sisters. The latter "stir" far more readily, 20 of 35 through switching on the light or calling, whereas this occurs in only four of 26 enuretics.

In order to achieve greater objectivity it was decided to examine a further 26 enuretics and their siblings by a questionnaire method, in which the parents wrote their own answers on paper (Table III).

The results are substantially in keeping with the other series. The enuretics are less easily awakened and their "stirring" threshold follows suit.

The opinion of the mothers as to the sleep state of their enuretic children may be gathered from the following comments. "Just not conscious enough"; "In the morning does not remember what she has done"; "If she had to take a tablet would not be awake enough to take it"; "Struggles, punches, bursts into tears, hangs her lip out, says 'what' 'what', does not realize what is happening". An amusing episode occurred in the case of an aunt with six non-enuretic sons. All would waken if she touched them and said "Come on". It became necessary to care for an enuretic niece. She looked forward to looking after a girl and thought it would be easy to cure her in view of her experience with her sons. She was amazed and "flabbergasted" that five minutes of tapping and talking were necessary before the child woke up.

TABLE I.

The Effectiveness of Wakening Procedures on Enuretics and Non-Enuretics (First Series).

Stimuli.	Numbers Woken.	
	19 Enuretics.	42 Non-Enuretics Siblings.
Switching on light	3	24
Calling child	—	19
Putting hand on face	—	34
Pulling off blankets	4	33
Shaking by shoulder	9	40
Standing on feet	15	40
Standing up and shaking	13	40
Smacking	16	40
Nothing wakens	2	—

I am indebted to my colleague, Dr. D. H. Ash, for permission to use his own records of a series of 31 consecutive enuretics (Table IV). These independent findings are convincing and suggest that the correlation between enuresis and sleep abnormality is closer than already suggested.

TABLE II.

The Effectiveness of Wakening Procedures on Enuretics and Non-Enuretics (Second Series). Data Obtained by Interrogation.

Stimuli.	26 Enuretics.			35 Siblings.		
	Stir.	Awake.	Not Awake.	Stir.	Awake.	Not Awake.
Switch on light	3	—	—	13	3	—
Calling child	1	2	—	7	6	—
Putting hand on face	7	—	—	3	3	—
Pulling off blankets	2	1	—	2	6	—
Shaking by shoulder	6	3	—	4	5	—
Standing on feet	4	1	1	2	6	—
Standing up and shaking	4	3	7	—	1	—
Smacking	—	—	8	—	—	1

The inference to be drawn from the four studies summarized in Tables I, II, III and IV is that deep sleep and half-awake states are more common in enuretics than in non-enuretics.

Observation in a Dormitory.

Any methods of research based on questioning of parents is open to the criticism that they are biased observers. In order to test the thesis further by more direct observation, permission was obtained for my visit to a Boys' Home. In the ward were eight enuretics and 12 non-enuretics. All were asleep. A member of the staff was instructed to wake each child in turn and send him to the lavatory. All the non-enuretics promptly grasped the significance of the order. Two were vocally indignant as they said they had been to the lavatory before going to bed, others looked surprised, most asked "What for?" The behaviour of the enuretics was quite different. They made no comments and were literally asleep on their feet. In order to reach the lavatory the boys walked down stairs. Whereas the non-enuretics made the journey smartly, the enuretics' gait was slow as if confused. One boy had to be helped, as he was in danger of falling over the banister. The staff, who knew the boys intimately, had no doubts concerning the deep sleep and half-awake state of enuretics. They said that if a bucket was used as a urinal, the enuretic was apt to anoint the observer! One is reminded of Trousseau's (1870) description of sleep in an enuretic as "so profound that it was exceedingly difficult to awake her. When loudly called and well shaken she neither heard nor felt anything; and when compelled to get out of bed, she seemed still to be asleep when on her legs".

Use of Measurable Sound Source.

In order to obtain even more precise data an attempt was made to assess the depth of sleep by means of measurable stimuli. Professor W. V. MacFarlane of the Department of Physiology, University of Queensland, suggested the use of and made available a noise source which gave readings in decibels and frequency. The orphanage kindly provided the facilities of a four-bedded room. The sound source was placed at the centre so that the head of each bed was equidistant (three feet). Forty-two estimations were made; 19 children had tests and at least two were performed on each child. As far as possible the routine was identical in each case. It was found that boys who had played strenuously during the day and were tired tended to sleep more deeply. In order to counteract this, all the boys were made to go to bed at the same time and to play the same games on the nights of the experiment. The boy to be tested had his usual period for reading or chattering. The experiment commenced when all were asleep. Sound frequencies commenced at 700 and were raised to 2000 if the patient did not awake in one and a half minutes. Decibels ranged from 30 to 50. The time of awakening was recorded by a stopwatch. In the series of seven enuretics, two were not awake even after six minutes of buzzing; this occurred in one non-enuretic. The average time for awakening the enuretic was greater than for the non-enuretic, being 418

TABLE III

Data Obtained by Questionnaire Alone (Third Series).

Stimuli.	26 Enuretics.			Non-Enuretic Siblings.		
	Stir.	Awake.	Not Awake.	Stir.	Awake.	Not Awake.
Switch on light	6	2	—	14	3	—
Calling child	1	—	—	6	7	—
Putting hand on face	1	1	—	5	7	—
Pulling off blankets	7	3	—	7	8	—
Shaking of shoulder	3	5	—	3	6	—
Standing on feet	1	2	—	—	6	—
Standing up and shaking	7	10	—	2	1	—
Smacking	1	1	2	—	1	—

TABLE IV.

Awakening Stimuli for 31 Consecutive Enuretics. (Dr. Ash's Series.)

Stimuli.	Numbers Awoken.
Switch on light	1
Call him	1
Hand on face	—
Pull blankets off	—
Shake by shoulder	5
Stand on feet	3
Stand up and shake	14
Smack	7

seconds for the former (seven cases) and 319 seconds for the latter (12 cases). The disparity is actually greater than this as an arbitrary awakening time of 720 seconds was given to both enuretics and one non-enuretic who did not awaken.

The foregoing evidence points to a correlation between the presence of enurésis and a disturbed quality of sleep, but to describe this in such terms as "hard to wake" or "high awakening threshold" is misleading. They suggest that sleep is merely a negation of the conscious life, as though the pressure of a button or a burst of decibels changes the one to the other.

Our experience with the boys in the orphanage highlights the problem. Even when the button is pressed there emerges not wakefulness, but sleep in disguise. There may be movement, even walking or micturition, but awareness is not present. The stranglehold of sleep remains; it has a quality of tenacity as though loath to permit consciousness to emerge to play a part in the night's affairs. The pattern is similar to that of infancy, which will now be discussed.

Sleep in Infancy.

Infantile sleep in normal health is tenacious, basic and overwhelming; it takes charge and is indeed the paramount influence in infant psychology. Not until the eighth month is there "sleep by choice" and the ridding of those subtle bonds which create sleep mastery. Examination of the newly born child shows that it sleeps for almost the whole day. Sleep is irresistible; it awakes only to feed and afterwards cannot be wakened. The general pattern of the sleep cycle has been graphically shown by Gesell (1915). The difference between day and night patterns is absent. If sleep and awake periods are recorded as black and white areas on a clock face, the black preponderates, the white appearing as mere white spokes on a black background. Even at the end of the first year sleep lacks the night pattern of the adult. A sleep interval at midday is normal until the third year. If efforts are made to awaken a healthy infant, he evinces the same type of sleep tenacity as was observed in the enuretic. There may be movement, resistance or eye opening, but this is without consciousness. It is contended that, in viewing this "movement without awakening behaviour", there is revealed a primitive or fossil type of sleep which antedates adult "sleep by choice" and serves an important evolutionary purpose.

Exterior Gestation and Primitive Sleep.

Impressions that evolution is limitless are sometimes expressed, but the scope of progress depends on inherent limitations to the basic plan. Thus, the ant, not the least intelligent and certainly one of the most industrious of the world's inhabitants, has existed as at present for 50 million years. Its size and potentialities have been inexorably limited by the type of respiration which it adopted. The existence of birds is dependent upon a delicate balance between wing strength, muscular power and weight. Very large birds such as the ostrich must forever remain grounded. Countless thousands of species, many of whose remains have been unearthed by geologists, have become extinct owing to an inherent inability to cope with change of circumstance.

Homo sapiens owes his survival to greater adaptability. None the less his continued preeminence is based on the immutable laws which govern all survival. It would seem that evolution at certain epochs reaches a stage requiring momentous decisions. Just as today we face the prospect of race suicide through man's meddling with chemistry, there have been others. Man's decision to walk upright, his choice of dextrous hand rather than fang and claw, his adoption of reasoned cunning instead of brute force, his use of speech, his perfection of stone weapons and their substitution by those of bronze and iron were decisions which led to success. Such records of triumph must not lead us to overlook our limitations, for there is a sombre shadow which, as with Jurgen, follows the steps of progress. The upright posture has produced a vast harvest of backaches, leg pains and foot miseries; our dextrous hands have created instruments of torture and guillotines as well as works of art; our cunning has produced rapacity and greed resulting in endless wars and unspeakable misery; our mastery of steel has made buildings and gardens to delight the gods, but often we have created slums and ravaged the earth.

It is now opportune to discuss another momentous step in evolution which, though brilliantly successful, has resulted in a frequent aftermath of disaster. Man, having assumed his upright posture, his achievement of manual dexterity, his beginnings of speech and his use of reasoned cunning, had increased his brain size to formidable dimensions. He had inevitably to face a hazard in reproduction. Female anatomy posed a query as to how a large-headed baby could pass through an aperture in the pelvic bone. The maximum size was dependent upon a large number of factors, since child-bearing is only one of many functions of the female, who must remain actively mobile and able to accomplish many chores inseparable from hard living. An enormous pelvis would be a hindrance. The size of the orifice must therefore be in harmony with functional efficiency in the whole life cycle. Nature evolved a pelvis-fœtal-skull ratio based on the compromise needs of both mother and child. It was not entirely satisfactory.

Light is shown on this by compromises evolved in other forms of life. Birds side-tracked aerodynamic difficulties by contriving land-based eggs for the gestation period. This device created difficulties since incubation necessitates a constant temperature. As a sitting parent bird is the heat source, its mobility is reduced. This has been disastrous for countless birds faced with predators. The marsupials devised a short interior gestation (e.g., in the kangaroo, this is 38 days), with a long external gestation in a special pouch.

The commonest solution among mammals is through mere manipulation of gestation periods. Very wide differences occur (Kenneth and Ritchie, 1955). Whilst the elephant takes 630 days, the opossum requires 13 days; a cow's gestation time is 275 to 291 days; a chimpanzee needs 210 to 248 days and man *circa* 280 days.

At first glance it would seem easy to correlate the gestation time with the weight of the parent or fœtus, but there are many exceptions. The tuatera lizard of New Zealand, an evolutionary patriarch of small dimensions, has an incubation period of 13 months. Whilst the brown bear and the pig have approximately the same birth weight, the gestation periods are in the ratio of 240:110. Though the young of the rhinoceros and hippopotamus are identical in size, the gestation times are of the order of 510 to 550 days and 210 to 250 days.

No matter how small a mammal, an appreciable time is taken for fœtal development. Thus the mouse, though 1/259,000 times the size of the elephant, does not have an incubation period in that ratio, but only 1:31·6. The explanation lies in the basic needs of development (Needham, 1931).

Whilst there is an optimum gestation period, length is varied by necessity. Thus predators must be agile to run down their prey, but as they can protect their young, the birth weight can be small. The lion has a gestation period of 105 days. The cold-water mammals such as seals must be able to withstand cold, swim and flee from danger soon after birth. They have long gestation periods of from 245 to 350 days. A baby elephant must be able to accompany the herd on its wanderings, so must be very mobile at birth. A long pregnancy is required (515 to 670 days). The ever-present danger of predators necessitates deer being able to run shortly after they are born. In order to do this there must be a long gestation period, e.g., that of fallow deer, which is 230 days. The above-mentioned data can be correlated if two principles are adopted—the optimum length principle and the specific adaptive principle. The optimum length of gestation is dependent upon such maturation of the neuro-muscular-skeletal development as will permit locomotion in order to avoid dangers.

In those cases in which the safety of the mother or fœtus necessitates the termination of interior gestation before maturation has occurred, there will be an adequate period of exterior gestation until the stage of effective quadrupedal locomotion is reached. If the definition of exterior gestation includes the period of maturation from the age of birth to that of effective quadrupedal locomotion, it will in man consist of the first eight to ten months of the first year of life. Optimum gestation and embryological growth follow a plan based on the orderly appearance of structural and physiological entities. Tilney and Casamajor (1924) have brought evidence to support Flechsig's fundamental law that the myelinization of the nerve fibres in the developing brain follows a definite chronological sequence. Fibres belonging to particular functional systems mature at the same time. By using a common and prolific animal such as a cat they were able to correlate its developing postural reactions with brain sections showing the process of myelinization. Behaviour patterns involving sucking, escaping, eye opening, washing the face with paws and climbing are quite distinct. All were explicable in terms of myelinization in appropriate circuits. Langworthy (1929-1932), making similar observations on opossums, kittens and humans, supported the view that the myelinization plan is similar in all mammals.

There is evidence, therefore, that function follows structure in orderly sequence. Under such conditions the ideal would be a gestation period sufficiently long to ensure optimum growth, in order to avoid functional hazards for which the fœtus is unprepared. In this connexion it is interesting to note that gestation periods in man have been recorded of up to 346 days and, significantly, babies who have had a long gestation period are healthy. Adequate maturity in the fœtus necessitates immersion in a water bath which, cushioning it from external stimuli, creates a state of security. Metabolism, oxygen exchange and excretion proceed with reliable automaticity. The whole process of living is one of streamlined efficiency.

It is contended that time limits to this ideal process were determined not for the reason that gestation had served its purpose, but because an entirely unrelated factor necessitated termination. Unless the developing head of the infant could emerge from the pelvic orifice, both mother and child must die. Evolutionary man has tenaciously striven to prolong internal gestation to the latest hour, if not moment. As a result, skilful assistance to the mother at birth is an important province of medical practice. Even with such help fatalities or injuries not infrequently occur to the mother or child.

Workers among babies soon realize that best results are achieved when the utmost of peaceful security is maintained. The hustle and bustle of the outside world must be excluded. Babies must live in an atmosphere very different from that of ordinary everyday living, and its main principles of isolation and security closely resemble gestation itself. It is indeed an exterior gestation.

The evidence of the infant is no less conclusive. For six months, as in the womb, it is compelled to be back-borne. Importantly, the major portion of its existence is spent in sleep, and it is not until the eighth month that sleep approximates to the adult pattern. About that time locomotion occurs and escape from danger is possible. Active contact with the outside world has become desirable. Exterior gestation is over; the child can crawl. It would seem that every child should have two birthdays—the first to celebrate release from the womb, the second its emergence from exterior gestation into quadrupedal activity.

In our research on the causation of asthma (Bostock, 1956) we were driven to the conclusion that insecurity produced by overt or hidden rejection by the mother, oversolicitude amounting to submergence by the mother, or bottle instead of the normal breast feeding, canalize into abnormal channels crying habits which are man's basis for primitive speech. The latter is his primordial defence and offence against danger. Insecurity so imprints the primitive speech mechanism on the plastic mind that in some people with respiratory disorders and insecurity there later emerge the bizarre symptoms of asthma.

If the concept of exterior gestation is accepted, it seems logical to presume that interference with isolation could have an effect on the sleep pattern of the child. Just as it is essential for adult man to keep awake for the greater part of each 24 hours in order to cope with environment, so it is essential for the neogestate to remain asleep. The maintenance of sleep level is a major problem. We are reminded of a remark by Claude Bernard: *"La fixité du milieu intérieur est la condition de la vie libre."*

The mechanisms for ensuring balance and control of internal states are usually discussed under the heading of homœostasis. Sleep levels in the neogestate warrant inclusion. Douglas Hubble (1957) has recently written of their underlying principles.

The first is that homœostatic mechanisms were established for survival in adaptation to an unkind world.

The second principle states that when the consequences of homœostasis are vital to survival, the body does not rely on a single mechanism, but has at its command several mechanisms all with a single objective.

His third principle discloses that when there are multiple mechanisms employed in homœostasis, some are designed for an emergency and others are used to meet a situation which may be indefinitely prolonged.

All three principles are applicable to the constancy of sleep. Sleep maintains integrity of the unconscious, excludes outer stimuli, and provides opportunity for basic physiological and chemical exchanges to take place uninfluenced by man's restless strivings in the awake period. More than one method is used to ensure its continuity. Provision is made for both emergency and long-term interference. An outstanding emergency mechanism for its preservation after interference is by the cry, which brings help and security. Pavlov's classic experiments with dogs point to another mechanism. The dog which is frustrated by stimulation without reward goes to sleep. Anxiety in patients is sometimes followed by overwhelming sleep.

Davis (1957), writing of the general principles underlying behaviour, states:

> Behaviour thus reflects disturbances in the internal state of the organism. Usually, but not necessarily, this disturbance is the result of changes in the external environment. In this sense, the organism is controlled by its environment, to which it adjusts in order to maintain itself. The adjustments may be "physiological" or behavioural or both. In adjusting to its environment, the organism may alter it in such a way as to lead to further disturbances; sequences of reactions are then instigated.

At first sight frustrations due to the over-toileting or babying in infancy may seem too trivial to cause serious sequelæ, but this is not the case. Reactions must be viewed in their own perspective. A situation which frustrates an infant might not frustrate an adult, but the latter situation is not under discussion. The cockpit experiments of Davis (1957) concerning the effects of frustration showed that with repetition minimal stimuli were able to evoke a response. This is directly referable to the infant, who suffers frequent interference in his "should be sleeping" and "evolutionary important" moments.

A baby is primarily conditioned to be awake when hungry, after which it sleeps. If survival requires the constancy of sleep, the effect of overstimulation could be countered by a deepening of the sleep threshold. Such a process in the adult is common. Over-play, over-exertion and over-work are followed if not by more sleep at least by more sleepiness. The threshold and the quality of sleep are altered. What is not so obvious is that the mechanism which protects the infant through sleep lays it open to the later disturbance of enuresis.

At this stage it is pertinent to ask whether there are particular influences in the lives of the enuretic which could have influenced the sleep homœostatic mechanism. This will be discussed in a second paper.

"INNOCENT" INVERSION OF THE T WAVE OF THE ELECTROCARDIOGRAM.

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Mistakes in the interpretation of electrocardiograms are more commonly due to over-diagnosis than to under-diagnosis. Physiological changes are regarded as abnormal much more frequently than significant signs of disease are overlooked. The former error can lead to the production of cardiac neurosis in a normal person, to his rejection for life assurance and certain types of employment, to loss of chances of promotion in a chosen career and to much unwarranted anxiety on the part of the patient's relatives.

For these reasons it is important that those who have the responsibility of reporting on electrocardiograms should understand the physiological variations which may be seen in the tracing of a normal subject. Of these the least well recognized appear to be the changes which can occur in the *T* waves in a variety of conditions unrelated to cardiac or systemic disease.

Carbohydrate Ingestion.

It has been recognized for years that an electrocardiogram taken after ingestion of 100 grammes of glucose will show flattening or inversion of the *T* waves (Goldberger, 1949), and it is possible that a high carbohydrate meal could produce similar results. However, it is doubtful if this is of practical importance.

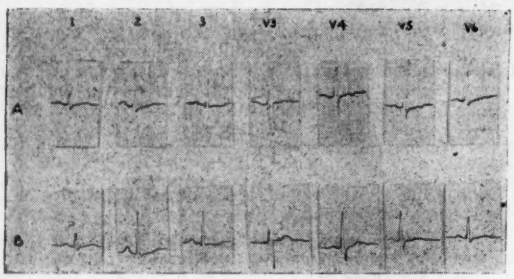

Figure I.

Electrocardiograms of an apparently normal young adult male. A were taken on October 10, 1956, and B on October 31. Note the difference in *T* waves in the two records, particularly in leads 3, V5 and V6. The probable explanation for the difference is the apprehension of the patient when the first electrocardiogram was taken, whereas he had recovered his composure when the second record was made.

Fear.

The effect of fear in flattening the *T* waves was first demonstrated by Mainzer and Krause (1940), and the influence of this and other emotions has been subsequently confirmed by numerous workers (Wendkos and Logue, 1946; Loftus *et alii*, 1944; Mangendantz and Shortsleeve, 1951).

Figure I shows two tracings taken nine days apart on a healthy young man who was examined routinely prior to employment as an aircrew member of a commercial airline. He was in a state of anxiety as the examination was important in determining the success or failure of his application for a coveted post, and it is probable that the flattening of the *T* waves on the first occasion was the result of this emotion. Clinical and radiological investigation of the patient revealed no evidence of heart disease, and the subsequent electrocardiogram was perfectly normal.

Another possibility which was explored was that an antimalarial drug, "Nivaquine", which he had been taking in prophylactic doses, had affected the *T* waves. "Nivaquine" has a chemical resemblance to quinidine, which may lower the *T* waves (Sagall *et alii*, 1943). The tablets were suspended for 48 hours before the second record was taken, but a further electrocardiogram taken after he had resumed the treatment failed to show any return of the flattening of the *T* waves.

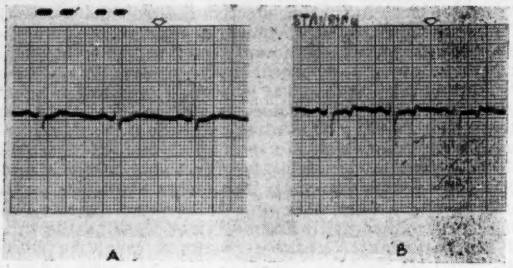

Figure II.

The effect of change of posture on the *T* waves in lead V4 of the electrocardiogram. A was taken with the patient supine; B with the same patient standing.

Similar changes in apparently healthy young men have been noted by others. It is extremely important that the influence of fear be borne in mind when the significance of flattening of *T* waves in an otherwise healthy subject is assessed.

Increased Sympathetic Tone.

Cannon was the first to emphasize the importance of the balance between the sympathetic and parasympathetic divisions of the autonomic nervous system in regulating all bodily functions. Each division exerts a continuous tonic

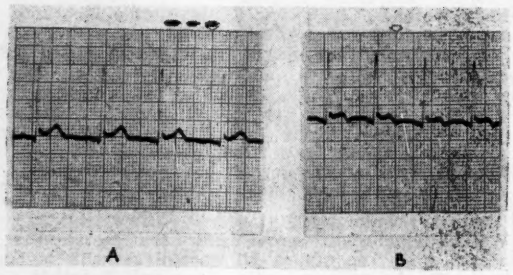

Figure III.

The effect of inhalation of amyl nitrite on the *T* waves in lead V4. A was taken before and B immediately after inhalation of amyl nitrite. The subject was a healthy male medical registrar, aged 26 years. Note the elevated *S-T* segments in both tracings due to early repolarization, giving an appearance in B which could easily be mistaken for the early stage of an infarct pattern. The *T* waves reverted to normal within the minute after the recording of B.

effect, which may be varied up or down. It is well recognized that any acute emotional stress will cause increased sympathetic activity, and that a sudden fall in blood pressure acts similarly. However, less acute psychic strain will do the same. Cannon himself pointed out the possible harmful effects of such long-continued emotion. "If no action succeeds the excitement and the emotional stress —even worry or anxiety—persists, then the bodily changes due to the stress are not a preparatory safeguard . . . but may be in themselves profoundly upsetting to the organism as a whole." (Cannon, 1933, quoted by White, Smithwick and Simeone, 1952.)

Any manœuvre which causes an increase of sympathetic tone leads to flattening or inversion of the *T* wave. The following are examples of this: (i) the effect of standing

upright (Figure II); (ii) the administration of drugs causing a rapid fall of blood pressure; (iii) the intravenous infusion of adrenaline. It is likely that fear acts through the same mechanism. In the case of (ii) there is a reflex increase of sympathetic tone to stabilize the falling blood pressure (Conway, 1955), with resultant *T* wave inversion, as after inhalation of amyl nitrite (Figure III). Similar *T* wave inversion has been noted during the hypotension which followed intravenous injection of four milligrammes of reserpine in a healthy young adult male (Maddox and Seldon, 1955).

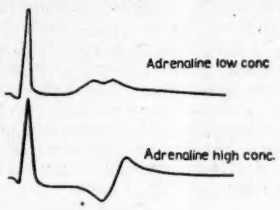

FIGURE IV.
The effect of intravenous infusions of adrenaline on the *T* waves.

Sjostrand (1951) has produced the same *T* wave deviations by intravenous infusion of adrenaline at rates ranging from one to 25 microgrammes per minute (Figure IV). It will be noted that smaller doses "dimple" the *T* wave while larger doses make it biphasic or inverted.

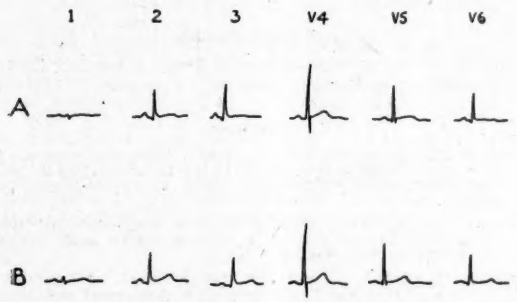

FIGURE V.
Electrocardiograms of the patient in Case I. A was taken on June 14, 1955. For B, see commentary in text.

When performing the above-mentioned experiments we have noticed that it is much easier to induce *T* wave inversion in some subjects than in others. This has been commented upon by Nordenfelt (1941), who described this susceptible type as "sympathicotonic". Certainly there is a tendency for these individuals to be tense and hyperkinetic. It is suggested that in such people an increased sympathetic tone may exist under certain circumstances with production of notched or inverted *T* waves, and the following cases are cited as examples.

Illustrative Case Records.

CASE I.—The patient was a man, aged 41 years, who had no significant previous history. He complained of epigastric fullness and mild pain only vaguely related to meals. He obtained some relief by taking food and alkalis. He had morning nausea and occasional dry retching with definite relief of symptoms. He also noted pain in the upper chest and left arm, not brought on by exercise but obviously worse when he was tired.

A barium meal X-ray examination was performed, and the radiologist reported that "The heart is normal in size and shape, and the lung fields are clear. The stomach is high in position with a wide cardiac shelf. No ulcer crater was detected. Tone is grossly increased and peristalsis is very active with gross spasm in the antral region. The duodenal bulb took five minutes to fill. It is irritable but appears regular when filled."

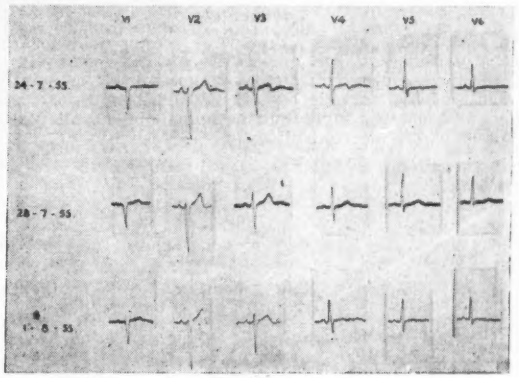

FIGURE VI.
Serial electrocardiograms of the patient in Case II, showing precordial leads only. Similar but less marked changes were seen in the standard leads. See commentary in the text.

An electrocardiogram (Figure V, A) showed inverted *T* waves in V4 and V5. Two monthrs later, after three weeks' holiday with great improvement of symptoms, the *T* waves were dimpled but not inverted (Figure V, B). Five months later, again during a period of greatly increased strain and overwork, the *T* waves had reverted to the shape seen in Figure V, A. At this time inhalation of amyl nitrite caused marked inversion of the *T* waves. At present, two years later, he is symptom-free, and the *T* waves are normal, but standing or inhalation of amyl nitrite reproduces the previous changes.

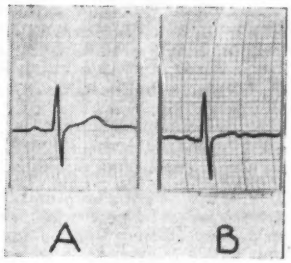

FIGURE VII.
Lead V4 from the patient in Case II on April 14, 1956. A was taken with the patient lying; B with the patient standing. Note the resemblance of B to V4 in Figure VI taken on August 1, 1955.

CASE II.—The patient, a man aged 40 years, who presented in July, 1955, with no family history of ischæmic heart disease, developed retrosternal discomfort and a feeling of weakness in the legs on the day after a late party. The electrocardiogram revealed suspicious features in the *T* waves of the precordial leads, and he was admitted to hospital for observation. During the next week the *T* waves alternated between normality and inversion; typical examples are shown in Figure VI. At no time was there clinical or laboratory evidence of cardiac infarction, and it became apparent that the *T* waves were not behaving like those of ischæmic heart disease. A barium meal X-ray examination revealed a diverticulum high up on the posterior surface of the fundus of the stomach, and it seemed probable that inflammatory changes in or near the diverticulum had produced the symptoms. The subsequent history of the patient showed quite clearly that recurrences of the

symptoms were related to dietetic indiscretions. Electrocardiograms taken on April 14, 1956, and on February 5, 1957, were normal, and on the former date lead V4 in the standing position reproduced the characteristic dimpling of the *T* wave seen in the tracings taken during the initial illness (Figure VII).

Comment.

In both these patients there was strong evidence that gastric dysfunction was responsible for the symptoms. In the former the digestive disturbance was itself presumably a result of his nervous tension acting through the autonomic system. The same influences undoubtedly altered the *T* waves of his electrocardiogram.

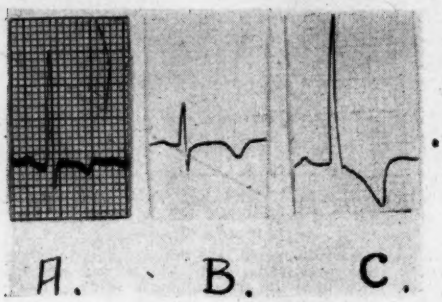

FIGURE VIII.

A: *T* wave of increased sympathetic tone. Note the asymmetrical shape and the slight overshoot following the sharper ascending limb. The *S-T* segment is iso-electric. B: The symmetrical inverted *T* wave of cardiac infarction. C: The asymmetrical *T* wave of left ventricular hypertrophy. Note that in this type the *S-T* segment is depressed, with the *S-T* take-off lower than the level of the *P-R* segment.

In the second case nervous tension generated by anxiety regarding the nature of the pain undoubtedly produced sympathetic overactivity and the characteristic electrocardiographic effect. It is of interest that in the tracing taken on July 24, 1955, the *P* wave is taller and thinner than in the other records, and this has been described as a typical result of sympathetic stimulation (Nordenfelt, 1941). The same alteration in *P* waves can be noted when Figure I, A, is compared with Figure I, B.

Discussion.

The inverted *T* wave of cardiac infarction is characteristically symmetrical, and at some stage of its evolution becomes relatively deep. Generally, the inversion persists for weeks, although it may eventually revert to an upright state. On the other hand, the inverted *T* wave of sympathetic overaction is asymmetrical and shallow and is followed by an overshoot (Figure VIII). It persists for only a few hours or at the most a few days. This physiological variant has been described by Nordenfelt (1941), by Wendkos and Logue (1946) and by Cannon and Sjostrand (1953); the last-named authors have reported such *T* waves in patients with psychoses, hyperthyroidism and phæochromocytoma. As would be expected, the sympathetic effect upon the *T* waves is generalized and is shown in all leads, although it is more apparent in some of the precordial positions, notably V4 and V5. These two leads frequently show partial inversion of the *T* wave, while in the other leads there is merely flattening.

Grant *et alii* (1951) have described the phenomenon of "isolated *T* wave inversion" in leads V4 and V5 in the electrocardiograms of five apparently healthy young adults amongst a series of 3000 consecutive electrocardiograms. This seems to be similar in appearance to the "sympathetic" *T* wave of the above-mentioned authors, but it differs in that it persists unchanged for months, the example depicted in their paper being unaltered after six months. Because of the lack of data concerning the subjects from whom these tracings were obtained, it is not possible to determine whether they are discussing the same condition as the other authors.

In the two cases described in this paper both the shape of the *T* wave and particularly the variability from day to day were suggestive of its non-ischæmic nature. Above all, the lack of a convincing clinical history of cardiac pain should warn the doctor to be on his guard when interpreting the electrocardiogram. However, it must be emphasized that this type of *T* wave is evidence neither for nor against the presence of ischæmic heart disease; it can be given no more weight than a normal tracing in the same circumstances, and it is well recognized that a normal electrocardiogram at rest does not exclude coronary artery disease.

In conclusion, it is worth repeating that while a deeply inverted symmetrical *T* wave is characteristic of ischæmic heart disease, *T* waves which are flattened, diphasic or slightly inverted may be physiological variants. In the last instance correct diagnosis will depend upon serial tracings and upon an accurate assessment of a detailed history *plus* physical findings and, if necessary, laboratory and radiological aids.

Summary.

The most common error in electrocardiographic diagnosis is to attach grave significance to normal physiological variations in the *T* wave.

Conditions which can cause "innocent" inversion or flattening of the *T* waves include fear, thyrotoxicosis, administration of certain hypotensive agents and increased sympathetic tone due to tension states in susceptible persons. Experimentally, ingestion of large amounts of glucose has a similar effect.

The importance of recognizing the non-specific nature of these *T* wave changes is emphasized.

Acknowlegement.

Figure IV is reproduced from a figure appearing in *Acta physiologica scandinavica*, page 247 of volume 24 (1951).

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AN ESTIMATE OF THE POTENTIAL LEUKÆMOGENIC FACTOR IN THE DIAGNOSTIC USE OF X RAYS.

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THERE is accumulating evidence that quite low levels of ionizing radiation can result in a detectable increase in the incidence of leukæmia. If one excepts debris from atomic explosions, the dose levels from which are of a much lower order, the diagnostic use of X rays is the most widespread man-made source of such radiation, and this paper is an attempt to relate the amount of radiation delivered to the bone marrow of the population from this source to that from natural sources, in order to assess its significance.

Some doubt still exists as to whether the relationship between the dose delivered and the incidence of leukæmia is linear or not, but the recent work of Court Brown and Doll (1957) suggests that it is, and for the present it is safest to assume that this is so.

There are some 4,600,000 X-ray examinations made in Australia in one year, and in the calculations which follow the distribution of these examinations and the number of films per examination as listed by the author previously (Martin, 1955 and 1958) have been used. The skin doses involved for any examination have been determined by many workers, and the average figures of Martin (1957) have been used here. The dose reaching bone marrow has been computed from these figures using appropriate depth dose data and the calculations of Spiers (1951 and 1957), the position of the marrow having been taken from standard cross-sections (Symington, 1917). The composition of the standard man has been used (*British Journal of Radiology*, Supplement No. 6, 1955), and the marrow has been taken as being distributed as follows. In adults, 25% is in the spine, 33% in the ribs and sternum, 33% in the pelvis and 9% in the skull. In children a more widespread distribution has to be allowed. There is 17% in the spine, 20% in the ribs and sternum, 20% in the pelvis, 17% in the legs, 14% in the arms and 12% in the skull. The results of the calculations are shown in Table I. It is interesting to note that despite the relatively low dosage involved, the radiographs of the chest contribute a large fraction of the dose to bone marrow.

Stewart and her colleagues (1956) have detected an increase in the incidence of leukæmia in children whose mothers received diagnostic X-ray examination during pregnancy. The levels of dose involved here (Martin and Williams, 1946; Clayton, Farmer and Warwick, 1957; Bewley, Lawes and Middleton, 1957) are low compared with the values in, say, the work of Court Brown and Doll (1957) on patients with ankylosing spondylitis. It is to be expected that the rapidly developing embryo will be more radiation sensitive than the adult, and the form of the change of sensitivity, if any, with age after birth is open to conjecture.

It is highly probable that children are more susceptible to damage from radiation than adults, and it follows therefore that the potential leukæmogenic factor resulting from the data of Table I may be greater than direct addition of the doses implies. For want of any relevant information, direct addition has been used here.

It has been stated that about a quarter of the 7,000,000 people over the age of 14 years are examined by mass miniature radiography each year, the contribution from this source amounting to 35,200,000 gramme rads *per annum*. Allowance for screening work amounting to 5% of all examinations carried out (Martin, 1958) brings the total annual contribution to 1,160,000,000 gramme rads which is equivalent to some 130 gramme rads per head of population *per annum*. The bone marrow dose *per annum* from natural sources is some 140 gramme rads, and the contribution from diagnostic radiology is thus of the same order as that due to unavoidable exposure.

Lewis (1957) has calculated the probability of induction of leukæmia based on a number of pieces of evidence and finds a probability lying between 0·000001 and 0·000002 per person per rad *per annum*. From these figures the incidence of leukæmia in Australia due to the use of diagnostic X rays can be estimated. The age distribution of persons presenting for X-ray examinations does not appear to differ greatly, except in the youngest age groups, from that for the population generally, and the average number of years of exposure has been taken as 34. Therefore the estimated incidence of leukæmia due to the diagnostic use of X rays is $34 \times (0{\cdot}000001 \text{ or } 0{\cdot}000002) \times 0{\cdot}09$. This is equivalent to between three and six cases per million per year. The incidence of leukæmia in Australia is shown in Table II, taken from the work of Lancaster (1955 and 1957). On this basis it will be seen that only some 5% of the cases could be due to the diagnostic use of X rays.

In the period 1936 to 1956, consumption of X-ray film for medical use in Australia has increased by a factor of nine,

TABLE I

Radiation Doses Received by Adults and Children.

Type or Site of Examination.	Adults: 4,000,000 Examinations *per Annum*.			Children: 600,000 Examinations *per Annum*.		
	Percentage of Cases.	Marrow Dose. (Gramme Rads ÷100,000.)	Percentage of Total Marrow Dose.	Percentage of Cases.	Marrow Dose. (Gramme Rads ÷1000.)	Percentage of Total Marrow Dose.
Extremities	22·5	—	—	26·2	2140·0	13·2
Thigh and knee	—	—	—	5·4	950·0	5·8
Skull *et cetera*	12·5	333·0	6·6	10·7	1040·0	6·4
Chest	24·7	516·0	10·4	37·4	10,000·0	61·5
Ribs	0·6	41·0	0·1	0·2	—	—
Pelvis	2·7	456·0	9·1	1·6	108·0	0·7
Cervical vertebræ	1·6	9·0	0·2	0·9	45·6	0·3
Dorsal vertebræ	2·2	620·0	12·4	0·2	89·6	0·6
Shoulders	1·9	11·7	0·2	1·9	93·0	0·6
Lumbo-sacral joint	4·0	1418·0	28·2	1·2	274·0	1·7
Hips	2·9	1205·0	24·0	6·4	1289·0	7·9
Urinary tract	5·2	68·8	1·4	0·3	68·0	—
Cholecystography	2·9	25·6	0·5	0·1	—	—
Abdomen	7·0	162·0	3·2	3·0	72·8	0·4
Barium meal and enema	2·5	158·0	3·1	2·3	69·4	0·4
Pyelography	2·7	19·0	0·4	0·3	—	—
Bladder	0·5	0·3	—	—	—	—
Kidney	0·2	—	—	0·1	—	—
Liver	0·1	—	—	0·2	—	—
Salpingography	0·1	2·0	—	—	—	—
Gall-bladder	3·2	11·4	0·2	—	—	—
Dental	—	—	—	0·8	59·2	0·3
Total	—	5019·9	—	—	16,298·6	—

while in the same period the sensitivity of X-ray film and screens together has increased by a factor of about five. It follows, therefore, that in 1936 the incidence of leukæmia due to diagnostic X rays would have been about half of that at present, that is again of the order of 5% of the total incidence. The information presented indicates that causes other than the diagnostic use of X rays must be sought to explain the large increase in the incidence of leukæmia in the adult population. That due to the use of radiation in diagnostic work could be substantially reduced, probably by a factor of about five (Martin, 1958).

TABLE II.

The Incidence of Leukæmia in Australia.

Period.	Deaths per Million *per Annum*.
1908 to 1910	29
1911 to 1920	36
1921 to 1930	34
1931 to 1940	51
1941 to 1945	63
1946 to 1950	85
1951 to 1955	95

Summary.

The paper computes the dose to the bone marrow of the population due to the diagnostic use of X rays, and it assesses the possibility of the increased incidence of leukæmia being due to the increased amount of radiation received by the population. Only some 5% of the cases occurring appear to be attributable to radiation so received.

Acknowledgements.

I am grateful to the staffs of Messrs. Kodak and Ilford in Melbourne for data on film consumption and on changes in film and screen sensitivity. My thanks are also due to my colleagues, Dr. R. Motteram and Dr. S. Were, for helpful discussions.

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SERUM PROTEINS OF SOME CENTRAL AND SOUTH AUSTRALIAN ABORIGINES.

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IN recent months expeditions have been made to study two different groups of aborigines. Members of several nomadic tribes, mainly Pitjandjara, Aranda and Pintubi, living in the neighbourhood of Haast Bluff in Central Australia, were studied in August, 1956. In June, 1957, a visit was made to the Ernabella Mission Station in the north-west of South Australia, where the natives are mainly Pitjandjara. On both occasions blood samples were taken, and the serum proteins of these samples were determined by paper electrophoresis. The same examination was made for a group of white controls. The results are presented, and a comparison of the albumin and globulin fractions of the aborigines and of the white population is made. The results are of interest as they provide an indication of the nutritional status.

Materials and Methods.

Collection of Blood.

The blood samples taken from aborigines in the Haast Bluff area were centrifuged soon after collection, and the sera were refrigerated immediately and sent in vacuum flasks by air to the laboratory for analysis. The blood samples from Ernabella Mission were refrigerated almost immediately and were centrifuged within two days of collection. The sera were frozen at -20° C. until analysis was made some weeks later. These sera appeared quite normal on thawing.

Paper Electrophoresis.

Serum in amounts of 0·02 millilitre was applied to papers (Whatman 3MM) and run at four volts per centimetre for 16 hours. The papers were dried at 50° to 100° C., and the proteins were fixed in ethanol containing 10% mercuric chloride. After the papers were dried, the sodium barbiturate was removed from them by immersing them in a water bath for two to three minutes. The papers were dried again and stained in an ethanol solution containing 1% (weight by volume) bromphenol blue and 1% (volume by volume) acetic acid. The papers were washed in 0·5% volume by volume acetic acid in distilled water until the dye bound to the proteins had changed to a green colour. The albumin and globulin bands were eluted with alkaline methanol, and the colour was read in a "Unicam" spectrophotometer (S.P. 600) at the optimum wave length, 595 millimicrons. Optical density readings were converted into terms of dye concentration from a "Unicam" calibration curve for bromphenol blue, and the globulin fractions were corrected for the albumin trail. Albumin and globulin standards were run concurrently. A more detailed study of the method by G. K. Wilkinson and G. N. Wilkinson will appear elsewhere.

Results.

A detailed account of the results is presented in Table I. A comparison of the two groups of aborigines shows that the levels of the total blood proteins of the Ernabella Mission natives, both male and female, are significantly lower than those of natives of the Haast Bluff area. This difference is contributed to mainly by the albumin level, which is significantly lower in the former group. The γ-globulin level of the Ernabella Mission females is also significantly lower, adding further to the over-all difference between the two groups.

When the white controls are compared with the Haast Bluff group the latter are found to show a total protein content significantly higher than that of the controls. This may be attributed almost entirely to the highly significant differences in the γ-globulin fraction. The albumin values are comparable in the males, although the

TABLE I.

Serum Protein Levels of Australian Aborigines Compared with Those of a Group of Persons of European Descent ("White Controls").[1]

Subjects.	Number of Cases.	Age in Years. (Mean.)	—	Concentration (Milligrammes per 100 Millilitres). Total Protein.	Albumin.	α_1 Globulin.	α_2 Globulin.	β Globulin.	γ Globulin.
1. Haast Bluff Aborigines.									
Males	24	38	Mean	7·71	4·73	0·27	0·71	0·58	1·43
				(0·20)	(0·12)	(0·04)	(0·04)	(0·04)	(0·09)
			Standard deviation	0·98	0·60	0·18	0·20	0·22	0·43
Females	32	30	Mean	8·04	4·58	0·41	0·82	0·65	1·59
				(0·14)	(0·11)	(0·03)	(0·04)	(0·06)	(0·07)
			Standard deviation	0·81	0·62	0·18	0·22	0·33	0·40
2. Ernabella Mission Aborigines.									
Males	24	29	Mean	6·72	3·95	0·35	0·64	0·55	1·24
				(0·18)	(0·10)	(0·03)	(0·03)	(0·03)	(0·06)
			Standard deviation	0·90	0·50	0·14	0·14	0·13	0·31
Females	19	22	Mean	6·68	3·86	0·45	0·62	0·54	1·21
				(0·19)	(0·11)	(0·03)	(0·03)	(0·03)	(0·08)
			Standard deviation	0·85	0·49	0·13	0·12	0·12	0·34
3. White Controls.									
Males	13	28	Mean	6·89	4·79	0·40	0·61	0·50	0·58
				(0·24)	(0·21)	(0·03)	(0·03)	(0·02)	(0·04)
			Standard deviation	0·88	0·76	0·10	0·09	0·08	0·16
Females	20	21	Mean	6·90	4·79	0·28	0·66	0·61	0·56
				(0·14)	(0·12)	(0·02)	(0·03)	(0·03)	(0·05)
			Standard deviation	0·63	0·53	0·10	0·11	0·14	0·23

[1] Estimated standard error is in each case shown in parentheses below the mean.

albumin level of the female aborigines is somewhat lower than that of their white counterparts.

In contrast to the Haast Bluff group the aborigines from Ernabella Mission have total protein levels which are of the same order as those of the whites. However, electrophoresis reveals that the γ-globulin fractions are again significantly higher in the aboriginal group, but that the albumin level is significantly lower.

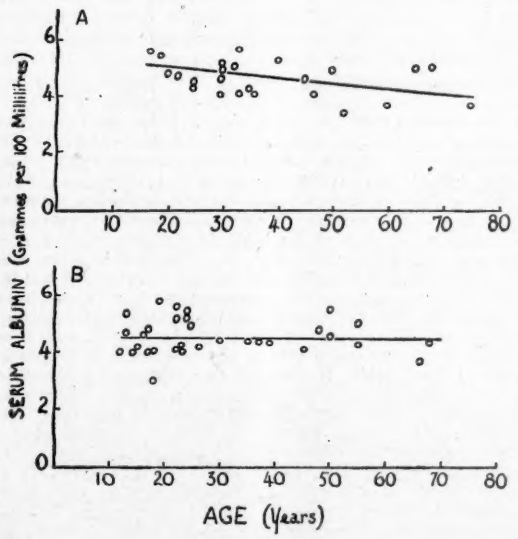

FIGURE I.

Scatter diagrams of serum albumin levels versus age in Haast Bluff aborigines. A, males; B, females.

A comparison of the remaining globulin fractions reveals that the α-globulin levels of the Haast Bluff group are slightly higher than those of the controls and of the Ernabella Mission group. The α_1-globulin levels were not determined with sufficient accuracy to warrant comparison. No differences were found in the β-globulin levels.

The albumin fraction of the Haast Bluff male aborigines shows a slight downward trend with increasing age, although a similar trend is not apparent for the females (Figure I). The globulin fractions do not appear to vary with age, and in particular no trend is observed in the γ-globulin fraction. The range of ages in the Ernabella Mission group is not sufficient for any trends with age to be detected. It may be noted that both the α-globulin fractions of the Haast Bluff females are slightly higher than those of the males. A comparison of the remaining fractions reveals no significant differences between the sexes.

Discussion.

With regard to the diet of the Haast Bluff aborigines several points might be noted (Tindale, personal communication). These people have a total dietary intake somewhat lower than the civilized white individual. The diet is obtained partly from animals killed in hunting, together with roots, leaves, berries, witchetty grubs etc., gathered mainly by the women. This is supplemented by government rations which include tea, sugar and flour, and, depending on circumstances, a reasonable supply of beef. The meat intake is actually higher in the workers, for whom additional meat is provided by way of reward. Since meat is given a high priority by them, males obtain the best of the diet. If any shortage of meat occurs, the females of the tribe—in particular the older females—will suffer. During the expeditions to the Haast Bluff area in 1956 and again in 1957 one of us (J.R.C.S.) observed the amount of beef distributed to the aborigines. The amount was rather more than would be consumed by an average white Australian, and even assuming unequal distribution between the sexes, it would constitute an adequate protein intake.

The adequate protein intake of the Haast Bluff group is reflected in the serum protein levels obtained. The albumin levels of the young men are high (4% to 6%). The albumin levels of the women from this area are on the average slightly less than those of the males; while this difference is not significant, it may reflect the greater protein intake of the males which is dictated by tribal habits. Even so the difference is only small, and the albumin levels of male and female aborigines are comparable with those of the whites. Further, the decrease of serum proteins with age in the males is similar to that found in a white civilization; it is unexpected that no decrease with age is found in the females.

However, it is of interest to find that the natives from the Ernabella Mission have albumin levels which are significantly lower than those of both the Haast Bluff group

and the whites. The country surrounding the mission is sheep country. The area has been largely eaten out, and game is not easily obtainable to supplement the government ration. Since sheep are kept largely for wool they are not available in any numbers to supplement the aboriginal protein intake. Recent observations by Duguid (1957, personal communication) reveal their diet to be largely carbohydrate with relatively little protein. These dietary differences are certainly manifested in the comparative serum albumin levels. While these are not down to malnutrition levels, they are certainly significantly lower than those of the other group of aborigines and of the white controls.

The high γ-globulin level of both groups of aborigines studied is of much interest. It is significantly higher than in the white controls for both males and females. In people of European descent a raised γ-globulin level is generally considered pathological and occurs with abnormal protein synthesis in the liver, or during infection, when it is considered to reflect an increase in circulating antibodies. Since it is known that aborigines have been exposed to such infections as Murray Valley encephalitis, "Q" fever, yaws etc. (Warner *et alii*, 1957), it is possible that the increase of γ-globulin may be attributed to this factor. However, no correlation was found when the individual γ-globulin values and the antibody titres obtained by Warner *et alii* were compared. Also the γ-globulin did not show an upward trend with age as might be expected if the circulating antibodies were responsible for the higher values recorded. Curnow (1957) also observed this high γ-globulin level in Western Australian aborigines, and in fact a high γ-globulin fraction appears to be characteristic of many dark skinned races. In Nigerians (Edozien, 1957) and in Navajo Indians (Page *et alii*, 1956) a similar elevation in γ-globulin has been observed. These authors have generally considered the difference to be of genetic origin. However, the fact that the γ-globulin level of West Africans falls after a prolonged stay in a civilized environment (Schofield, 1957) suggests that the initially high level is not readily explicable in such terms. The reason for the γ-globulin increase in the Australian aboriginal may or may not be genetically determined, but any explanation can only be speculative in the current state of knowledge.

Summary.

Serum protein determinations were carried out by paper electrophoresis on aborigines from Haast Bluff in Central Australia and from the Ernabella Mission in South Australia. The serum albumin level was low in the Ernabella group, but normal in the Haast Bluff group. The γ-globulin was considerably elevated in both groups. These findings are discussed in terms of the dietary intake of these peoples.

Acknowledgements.

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SALMONELLA OSTEOMYELITIS IN INFANCY WITH A CASE DUE TO SALMONELLA NEWPORT INFECTION.

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Reports of osteomyelitis due to organisms of the salmonella group appear infrequently, and most authors lay emphasis on the rarity of osteomyelitis as a complication of salmonella infections.

Winslow (1923) found that the incidence of osteomyelitis as a complication of typhoid fever was 0·82%, and that 0·45% of all cases of osteomyelitis were of typhoid origin. These figures were closely paralleled by those of Keith and Keith (1926), but it would seem probable that, after an interval of 30 years, they no longer afford an accurate indication of the incidence.

It seems to be generally agreed that osteomyelitis due to salmonella infection other than typhoid is very much more rare, and while infection due to *Salmonella paratyphi B* probably comes next in frequency, Webb-Johnson (1917) found only two examples of paratyphoid B osteomyelitis in a series of 1038 cases, and Veal and McFetridge (1934) reported two cases, bringing the total number then on record to 18. These authors pointed out that the reported cases cannot represent more than a fraction of the total incidence of osteomyelitis due to *S. paratyphi B.*

In a recent publication, White and Meynell (1956) stated that they could find only 28 reported cases of osteomyelitis due to salmonella other than *S. typhi* or *S. paratyphi B.* They reported the first recorded case of osteomyelitis due to *S. paratyphi C*, which had occurred in a Jamaican aged 40 years. Apparently *S. paratyphi C* is the commonest of the salmonella group in the West Indies, but the patient, who had been living in Great Britain for a year, had never, as far as he could remember, suffered from any acute gastro-intestinal disturbance.

The occurrence of an interval of latency between the gastro-intestinal attack and the osteomyelitis is a feature of the majority of reported cases in which the gastro-intestinal attack has been identified, the interval being weeks, months or even years. For example, Giacci and Idriss (1952) reported the case of a girl, then aged six years, whose gastro-intestinal attack probably occurred at the age of 18 months. This was followed two years later by intermittent and undiagnosed bone pain and swelling with no radiological evidence of osteomyelitis, but when she was four and a half years old, *S. enteritidis* was cultured from pus obtained at operation for acute osteomyelitis of the tibia. The child subsequently suffered several recurrences of the infection, involving different bones. Whenever there was a recrudescence with involvement of new bones it seemed that chloramphenicol was effective against the bone localization in the early stage, but it did not prevent relapses, though it was once given for as long as six weeks. In the opinion of these authors, this suggested the existence of encapsulated nests of *S. enteritidis*, which were not reached by the antibiotic and which every now and then became active and spread through the blood stream to attack new bones. It seems probable, however, that the metastasis to these bones may have occurred at the time of the original infection.

Macdonald (1941) had suggested that enteric organisms may persist in the bone-marrow for long periods, and Lever and Barker (1945) reported a case of osteomyelitis in a man aged 40 years, whose gastro-intestinal infection had occurred 33 years before; they state that localized injury with subsequent typhoid abscess formation is a frequent feature in cases in which an acute focus of infection has appeared after a long interval. However, this behaviour is not confined to enteric organisms, for Brodie's abscesses due to infection with pyogenic cocci may manifest themselves up to at least 30 years later.

A study of the various reports of cases of salmonella osteomyelitis fails to reveal any characteristic clinical picture or mode of progression. Some cases, for example

those of Veal and McFetridge (1934) and of Jetter (1938), were acute in onset and eventually fatal, while on the other hand the case already referred to, reported by Giacci and Idriss, had an insidious onset and a chronic course. These authors were of the opinion that, as a rule, the longer the interval between the acute intestinal infection and the onset of the osteomyelitis, the milder would be the clinical course of the latter condition.

Weaver and Sherwood (1935) reported the case of a girl, aged nine months, whose osteomyelitis was found to be due to *S. suipestifer*. They observed that the child had not appeared acutely ill, and they found reports of eight other cases (three of osteomyelitis and five of pyarthrosis) which showed a striking similarity. All the children were very young, the oldest being aged 19 months and the youngest five weeks; the disease in each case was mild, and there were no deaths. In those children with osteomyelitis the primary focus had been, without exception, in the epiphyseal line, usually with direct extension into the joint.

Veal (1939), in a discussion of typhoid and paratyphoid osteomyelitis, differentiates between the bone lesions in the two conditions, stating that in paratyphoid infections the disease is more acute, it often runs a febrile course, and there is more often leucocytosis. The bone lesions, he states, often occur during or very soon after recovery from the systemic infection and are frequently multiple. When long bones are involved the process begins in the diaphysis, but is likely to spread through the entire length of the bone. He considers that the earliest lesions, as demonstrated by X-ray findings, consist in thickening and elevation of the periosteum, but after the process has developed to suppuration there is little to distinguish it from staphylococcal or streptococcal osteomyelitis except that the shaft of the bone is more involved than the metaphysis.

It may be said, therefore, that osteomyelitis due to salmonella infections exhibits no specific features, save possibly an interesting association to which attention has recently been drawn. This is the unusual frequency of osteomyelitis due to salmonella organisms in children with sickle-cell disease, and its occurrence in other varieties of abnormal hæmoglobin disease.

Silver, Simon and Clement (1957) have reviewed the literature relating to the association of salmonella osteomyelitis and sickle-cell anæmia and have tabulated 24 reported cases. They add to the list two cases, one in a white boy with combined sickle-cell-Mediterranean anæmia, and the other in a negro girl with hæmoglobin C-D disease. The former represents the first reported case of salmonella osteomyelitis in a patient with a mixed heterozygous hæmoglobin disease, while the latter is the first to be recorded in a patient with hæmoglobinopathy without sickling.

Hughes and Carroll (1957) had already emphasized that children with sickle-cell disease had a tendency to develop osteomyelitis, that salmonella organisms were frequently the infecting agents, that in such cases there was a disposition to multiple bony involvement and that the affected bones showed a characteristic radiographic appearance. This appearance was first described by Wigh and Thompson (1950), the most distinctive feature being the presence of linear intracortical fissures lying parallel to the long axis of the shaft. These fissures, which were adjacent to and of equal length with the medullary osteomyelitis, showed as radiolucent lines, whose width varied from one to three millimetres throughout their length. The fissures and the medullary lesions healed simultaneously, and the shafts of the affected bones became thickened.

Discussing the possible explanations of the increased incidence of salmonella osteomyelitis in patients with abnormal hæmoglobin disease, Silver, Simon and Clement (1957) suggest that while in most cases of salmonella septicæmia the natural defences of the body will eventually destroy those organisms which have lodged in the bone marrow, in certain cases local factors such as inflammation, thrombosis and necrosis might predispose to the development of osteomyelitis. These conditions occur in some patients with certain abnormal hæmoglobin diseases, and so the likelihood of the development of osteomyelitis is increased. An alternative possibility is that organisms are more likely to localize in tissue with a poor vascular supply so that humeral antibodies and antibiotic drugs are less capable of counteraction.

The infection in the case reported below proved to be due to *S. newport*. Of the many salmonella types occurring in Australia and described by Atkinson *et alii* (1952, 1953), *S. newport* strains, although not numerous in the series, are by no means among the least common. They were recovered from human beings (mainly children), from chickens and from animals such as the sheep and pig. Lee and Mackerras (1955) have also reported the occurrence of *S. newport* in the bandicoot. The strains reported by these writers came from Queensland, New South Wales, Victoria and South Australia, and it is of interest that the great majority recovered from children with gastroenteritis were from Queensland. It is believed that no case of osteomyelitis due to *S. newport* infection has hitherto been reported.

Report of a Case.

The patient, a boy, aged 10 months, was admitted to the Mater Misericordiæ Children's Hospital, Brisbane, on January 14, 1956. For the preceding three weeks he had been treated at home for diarrhœa and had been passing loose stools containing blood and mucus. At the height of the attack the bowels had been acting six times a day, but his condition had improved and the stools had been normal since January 9. On January 10 his doctor was called to see him because he was screaming whenever he was moved. He was found to have a slightly elevated temperature, but no cause could be found for it apart from an appearance of mild pharyngitis. When the doctor saw him next day he noticed that he would not use his left arm. The mother said the child had had a slight fall the previous evening. A fractured left clavicle was suspected and a figure-of-eight bandage applied, but when next seen by his doctor on January 13 the child was still crying when moved and his temperature was 100° F. He was given an injection of procaine penicillin (300,000 units), but had no sleep that night. Next day his temperature was 103° F., and he was referred to hospital.

Examination on his admission to hospital showed him to be a robust child with no wasting or other ill effects of his diarrhœa. His temperature was 103° F., and he was irritable and crying so much that localization of pain to the left shoulder could not be made with certainty. No cause could be found for his raised temperature.

An X-ray picture of the left shoulder region showed no bony abnormality in the clavicle or upper end of the humerus. The hæmoglobin level was 66% (9·3 grammes per 100 millilitres) and the white blood cells numbered 10,000 per cubic millimetre (45% being neutrophils, 54% lymphocytes and 1% eosinophils). A bowel smear was taken on the day after his admission to hospital, and from it polyvalent salmonella organisms were cultured.

The child's temperature, which had been high on his admission to hospital, gradually fell and was normal on January 17, but during the next few days it varied between 98° F. and 101° F. The child did not seem very sick, and though he did not use his left arm he was happy when undisturbed. Attention was still focused on the possible results of trauma, but the mother now revealed that the fall before his admission to hospital had been very slight; the child had been knocked over from a sitting position.

On January 23, nine days after his admission to hospital, swelling was present in the left axilla. In view of this and the continuing fever, treatment with penicillin (50,000 units every three hours) was begun and a further X-ray examination was made; this showed faint irregularities of mineralization in the upper end of the left humerus, a translucent zone being evident just beneath the epiphyseal line. A diagnosis of osteomyelitis was now made, and treatment with penicillin continued until January 25, when, as the temperature was still raised and the swelling more pronounced, oxytetracycline (100 milligrammes every six hours) was substituted. However, no improvement occurred. Throughout this period the child appeared reasonably well and comfortable. The left arm was immobilized, and he played happily in his cot and took his food well. His bowels were acting normally, once or twice daily.

It may be observed at this point that almost from the outset this child had shown one of the classical features of joint sepsis, namely, screaming when handled or when

attempts were made to move the affected joint. Also, a careful rescrutiny, in the light of subsequent developments, of the X-ray film taken on his admission to hospital showed that the osteomyelitis was beginning at that stage and that probably there was already a joint effusion present. Further X-ray examinations between January 14 and January 23 might therefore have led to earlier certainty of the presence of osteomyelitis, but this would have been a general rather than a specific diagnosis, and though a different scheme of antibiotic treatment might have been adopted, it is doubtful whether it would have affected the outcome.

It was not until January 29, 19 days afer the first evidence of pain, that an operation was performed and an abscess was found under the left deltoid muscle. At operation it was seen that the osteomyelitis had advanced fairly rapidly in spite of antibiotic treatment, and had eventually involved the upper end of the diaphysis and the metaphysis to a considerable extent. An abscess had developed at the metaphyseal area and had burst through the cortex and periosteum to the subdeltoid area. The operation performed was a standard guttering, and the Winnett-Orr open treatment was adopted. In addition the joint was opened and much sero-purulent fluid evacuated, the joint being left draining. Pus was taken for culture, and on February 1 the report was as follows: "*S. paratyphi* cultured. Sensitive to chloramphenicol, slightly sensitive to terramycin, resistant to penicillin."

Treatment was now changed to chloramphenicol 50 milligrammes every four hours and sulphadiazine 0·3 gramme every four hours; this regime was continued for three weeks. The temperature fell quickly and remained normal from February 10 until his discharge from hospital on February 26. During that time the wound was dressed at weekly intervals, and swabs were taken for culture. The reports were as follows. On February 9 and 16 *S. paratyphi* and Gram-positive cocci were cultured; on February 23 *S. paratyphi* C and staphylococci were cultured. A specimen from the culture of February 23 was sent for typing to the Department of Bacteriology in the University of Adelaide, where it was identified as *S. newport*. A culture from a bowel smear taken on February 1 was reported negative, and agglutination tests performed on February 20 also yielded negative results.

The patient was discharged from hospital on February 26, but remained under continued supervision as an out-patient. No sequestra formed, and the wound was healed in two months, but serial X-ray examinations during the following months showed that the shoulder epiphysis of the humerus had become deformed and diminished in size, and that apparently necrosis had occurred. Periodic observation continued, and 18 months after the infection the epiphysis and shaft of the humerus showed normal structure, though the shaft still remained thickened. There was no residual infection at the metaphyseal site, and when last examined in October, 1957, the left upper limb was normal in all respects.

Comment.

From time to time, over a period of 30 years or more, interest has been aroused in the occurrence of osteomyelitis due to organisms of the salmonella group, chiefly on account of its rarity, or the rarity of its recognition as such. Many attempts have been made to extract, from the available clinical data, features that could be combined into a distinctive clinical picture characteristic of this type of infection. Although such points as the occurrence of many cases in young children, the tendency to an interval of latency and the relative mildness or chronicity of the symptoms in some cases have all been used in these attempts, it will be realized that not only are these features inconstant among the various series, but also they are non-specific and can occur in osteomyelitis due to many other types of infection. For this reason the relatively recent recognition of the association between salmonella osteomyelitis and certain blood diseases is of particular interest, especially as it seems that there is a distinctive radiological appearance accompanying such cases. It appears probable, however, that this interesting association and its X-ray appearances are due more to the existence of the blood disorder than to the type of organism concerned.

The case due to *S. newport* infection here described is reported more on account of the unusual nature of the infection than because of any specific features. In fact, although the course and successful cure of the disease and the occurrence of epiphyseal changes were interesting, the osteomyelitis and joint infection in this case displayed no differences from those seen in osteomyelitis due to pyogenic cocci. However, the report may serve as a reminder of osteomyelitis or joint infection as possible or indeed likely causes of a young child's screams and resentment of movement, and of the necessity for more frequent and careful X-ray examination while these symptoms persist.

While bacteriological diagnosis can only be made from aspirated pus, the use of chloramphenicol would seem to be indicated in resistant cases of osteomyelitis, especially when it occurs in children with a recent history of a severe gastro-intestinal disturbance.

Summary.

Various reports of osteomyelitis due to organisms of the salmonella group are examined, but it is concluded that no specific clinical picture has been defined.

Attention is drawn to the association between salmonella osteomyelitis and various blood disorders and to the distinctive X-ray appearances that have been described in some of these cases.

A case of osteomyelitis due to *S. newport*, which showed various interesting features and which was successfully treated, is described.

Acknowledgements.

I wish to thank Miss Nancy Atkinson of the Department of Bacteriology, University of Adelaide, for the identification of *S. newport*, and Dr. Ian Mackerras for his advice and help regarding salmonella infections. I am particularly indebted to Mr. J. R. S. Lahz, Honorary Orthopædic Surgeon to the Mater Misericordiæ Children's Hospital, at whose suggestion this paper was written and who supplied the orthopædic details about the case reported.

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THE GUILLAIN–BARRÉ SYNDROME WITH SPECIAL REFERENCE TO RESPIRATORY PARALYSIS AND RECURRENCE.

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IT is our intention to review the Guillain-Barré syndrome and its management with special reference to recurrence and the complication of respiratory paralysis, and to present a case demonstrating these features.

The ætiology of the syndrome is still the subject of much interesting discussion. Infection with a specific virus has never been proven, and attempts to transmit the disease or to culture a virus have failed. Very good evidence has also been adduced against a virus causation (Miller and Gibbons, 1954): meningism is often absent, there is no fever and pleocytosis is slight or absent in the cerebro-spinal fluid. The pathology is not that of an inflammatory disease. The failure to develop clinical immunity will be discussed.

The theory of hypersensitivity to some preceding antigen has much in its favour (Miller and Gibbons, 1954; Stanton, Miller and Gibbons, 1953; Jackson, Miller and Schapira, 1957). These authors point out that there may be much in common between acute ascending paralysis of Landry, polyradiculoneuritis of Guillain, Barré and Strohl, acute disseminated myelitis, post-infectious encephalitis, acute disseminated encephalo-myelitis and brachial radiculo-neuritis. Any of these conditions may follow vaccination, inoculations, serotherapy, exanthemata such as measles, chicken pox or rubella, mumps, infectious mononucleosis, infectious hepatitis, brucellosis, virus pneumonia or non-specific upper respiratory tract infections. There is a variable latent interval as in diseases of hypersensitivity, and they may be associated with more specific allergic phenomena such as urticaria, purpura, acute nephritis or rheumatism. The syndromes in this group may overlap one another, and polyradicular lesions may be associated with encephalo-myelitis. Recurrences occur chiefly after non-specific upper respiratory tract infections, which themselves are liable to recur because of the lack of lasting immunity. Finally there are a number of similar syndromes very difficult to differentiate clinically but which are very different pathologically, such as those due to direct virus invasion of the central nervous system, syphilitic myelitis, porphyrinuria, carcinomatous metastases and leukæmia.

The pathology of the Landry-Guillain-Barré syndrome, in common with acute disseminated encephalo-myelitis and the other members of this group, is not inflammatory. In the condition under discussion there is initially œdema of the radicular nerves extending to the nerve roots and peripheral nerves (Haymaker and Kernohan, 1949). Soon the axis cylinders and myelin sheaths become irregular and swollen, and later lymphocytes and phagocytes appear and there is proliferation of the cells of the sheath of Schwann. Such cells as are present represent a reaction to the degeneration rather than evidence of inflammation. The swelling of the nerve roots and radicular nerves within the dural sheaths probably accounts for the high spinal fluid protein level as one-fifth of the cerebro-spinal fluid protein is absorbed within the spinal nerve root dural sheaths. There may be chromatolysis of the cells of the anterior horns, but this is probably a change secondary to nerve root degeneration. However, more extensive changes have been described throughout the central nervous system (Lowenberg and Foster, 1945). Severe degeneration of the white matter of all columns of the spinal cord may occur and may extend as far as the thalamus.

The illness is often preceded in the previous six weeks by an infection, commonly of the upper respiratory tract. However, the onset is usually afebrile, and the initial symptom in most cases is a sensation of numbness or tingling in the distal parts of the limbs. In some the onset is with weakness and in others with motor and sensory features together. The initial symptoms are usually noted in the lower limbs, but sometimes in the upper limbs or cranial nerves. The proximal muscles of the limbs are those most severely affected. The course may be so rapid that the order of spread is not obvous, but usually it will be observed to spread from lower to upper limbs and thence to the cranial nerves, trunk and intercostals, and it is usually symmetrical.

Pain or tenderness of muscle or nerve may occur as well as paræsthesiæ. There seem to be all gradations between purely motor (as in the cases originally described by Landry) and equal motor and sensory involvement. The longer the duration of the illness, the more severe and extensive the sensory changes. Though usually there are said to be few objective sensory changes, hypoæsthesia or anæsthesia on the one hand and changes in deep sensibility on the other, each occurred in about 38% of the cases reported by Haymaker and Kernohan.

Some disturbance of the ninth and tenth cranial nerves is very common, and the seventh is the next in frequency. Reports indicate the possibility of involvement of any cranial nerve with the exception of the first and the eighth. Muscle tone is flaccid, and the tendon reflexes are widely lost, the loss extending well beyond the area involved by weakness. The plantar responses are flexor, the occasional extensor response being thought to result from the spread of the process to the spinal cord. Urinary incontinence or retention may be seen, but is mild and transient, rarely giving rise to any difficulty. Signs of meningeal irritation are inconstant. Pulse and respiratory rates tend to be raised during the course of the illness, but the temperature is normal unless there is associated infection. Haymaker and Kernohan (1949) report malignant hypertension in as many as one-fifth of their patients; in one the diastolic pressure was 162 millimetres of mercury. Elevation of blood pressure is often due to carbon dioxide retention resulting from respiratory insufficiency.

The spinal fluid changes, emphasized so rigidly by Guillain, are no longer of such importance, as atypical findings frequently occur in cases which otherwise present a typical clinical picture. The protein level tends to rise early; it may be high initially or in the first four days and may continue to rise for the first week, remaining high for several weeks. However, it may be normal at the onset, and some rise in the cell count often occurs, figures as high as 100 to 200 per cubic millimetre having been recorded. Albumino-cytological dissociation, a high protein content and no rise in the number of cells, is thus not a necessary feature of the disease.

Management.

As in any flaccid weakness every joint must be moved through its full range of movement every day, and splints must be fitted at night to prevent contractures. Frequent changes of limb position do much to relieve discomfort, and turning from side to side will minimize the danger of bed sores.

Cortisone and corticotrophin have been used in the hope of shortening the course of the disease. Jackson, Miller and Schapera (1957) reviewed 69 cases in the literature of patients treated wth corticotrophin. Twenty-one of these patients recovered completely within one month, suggesting an increased rate of recovery, and they were of the opinion that treatment within the first month may produce a sudden and sustained response. Recovery may be in two stages: an initial rapid one due to absorption of the œdema round the nerve-roots with relief of pressure, and a slower stage lasting several months due to the regeneration of axones damaged during the active disease process. The response to steroid therapy will be rapid if the symptoms are due to œdema alone, but will be slower if there is much axonal damage.

Respiratory paralysis is a major complication of this disease and necessitates meticulous observation for its early detection in patients with rapidly progressive poly-

neuritis. The progress of the paresis must be noted carefully and chest expansion and talking tolerance assessed. Spirometry will demonstrate respiratory insufficiency, but an early and reliable bedside sign is a measure of the length of conversation required to tire the patient. Russell (Debre *et alii*, 1955) suggests that the patient's maximum count in one breath provides a useful measure of vital capacity, and that when the count is less than 10 or when the vital capacity is less than 1000 millilitres, assisted respiration should be considered seriously.

The mechanisms protecting the lung from aspiration of secretions also require careful attention. Weakness of the abdominal muscles renders coughing less effective, and difficulty in swallowing and nasal regurgitation indicate bulbar involvement and the consequent danger of pooling of secretions in the pharynx. Failure of adequate respiration may be due to diminished respiratory excursion or to obstruction of the air passages or to both of these. Temperature, blood pressure and pulse and respiration rates recorded hourly provide an early indication of inadequate respiration. Carbon dioxide retention will cause a rise in blood pressure, sweating, slowing of the pulse, restlessness and eventually loss of consciousness. The chest must be examined frequently and the position of the apex-beat recorded for evidence of atelectasis.

When there is difficulty in swallowing, and pooling of secretions occurs without any evidence of respiratory insufficiency, postural drainage and repeated pharyngeal suction alone are required. For pure spinal respiratory weakness without bulbar involvement, the tank respirator is still used. But, whenever there is a combination of both spinal and bulbar involvement with diminished respiratory excursion and ineffective cough on the one hand and pooling of pharyngeal secretions and defective swallowing on the other, tracheotomy is essential. This is usually combined with intermittent positive pressure (I.P.P.) respiration, and by this method the mortality rate of respiratory paralysis in poliomyelitis epidemics has been reduced from 80% to 20% (Lassen, 1953), although equally good results have been claimed from the use of tracheotomy and a tank respirator (Forbes, 1955).

The great advantage of tracheotomy and insertion of a cuffed tube is that inhalation of pharyngeal secretions or vomitus is prevented, and bronchial secretions can be readily aspirated with a Tiemann's catheter through the cuffed tube. Aspiration should be performed gently and at least every hour, or more frequently if the respiration is noisy or if there are signs of inadequate ventilation, and it should be combined with postural drainage and physiotherapy. The cuffed tube should be cut short, and the tracheotomy should be high to prevent the tube causing obstruction to one or other main bronchus. The cuff must be deflated for about five minutes every two to four hours to prevent pressure necrosis of the trachea, and it is advisable to insert a fresh tube every day.

The advantage of I.P.P. respiration over the tank respirator is the ready accessibility of the patient for changes of posture and physiotherapy. Smith, Spalding and Russell (1954) discussed the important features of I.P.P. respiration. A humidifier must be provided to keep the secretions fluid. The expiratory phase should be twice as long as the inspiratory phase and should occur without any resistance from the valve, allowing intrathoracic pressure to fall to atmospheric level. This assures that the mean intrathoracic pressure is not so high as to hinder venous return to the heart, thus causing a serious fall in cardiac output. The pressure in the conduit system should be measured by a gauge as near to the tracheostoma as possible to prevent excessively high pressures being produced in the lung.

With fully automatic machines, regulation of ventilation requires very great care. Carbon dioxide retention suggested by a steadily rising blood pressure and by blood carbon dioxide combining power indicates the need for greater ventilation. Overventilation may be avoided by any rise in urinary pH being noted or by the patient's subjective feelings being followed, provided consciousness is not disturbed. The respiratory pressure will usually be set between 15 and 20 centimetres of water and the rate between 16 and 20 per minute.

When I.P.P. respiration is in progress it is doubly important to continue charting the temperature, blood pressure and pulse and respiration rates. The chest must be carefully examined at least twice a day, and in the early stages an X-ray examination of the chest should be made every day or so. While on assisted respiration the patient may develop clinical and radiological signs of atelectasis without obvious distress, or dramatic change in the blood pressure or pulse rate.

Physiotherapy is vital. Adequate postural drainage can be obtained only with the patient in the lateral or semiprone position. He must be nursed in this position and changed from side to side every two hours. Percussion and vibration are applied to the chest as frequently as they can be tolerated with the foot of the bed raised and in conjunction with intratracheal suction. This will usually be sufficient to prevent or relieve bronchial obstruction, but occasionally bronchoscopic suction may be necessary.

The feeding of patients with respiratory paralysis is by gastric tube with close attention to the intake of fluids, electrolytes, protein, calories and vitamins. In the presence of gastric atony feeding has to be by the intravenous route with continuous gastric suction, but if possible this is best avoided as the risk of pH and electrolyte disturbance is already considerable.

Report of a Case.

The patient was a school-boy aged 17 years. At the age of 11 years he had been admitted to another hospital complaining of weakness in walking for two weeks and pins and needles in his feet for three days. These symptoms gradually extended to the arms, where the weakness was of the proximal muscles, the fingers having been normal throughout the duration of the illness. After five weeks in bed recovery began, and he was discharged from hospital after nine weeks. There was no note of any objective sensory change, and there was apparently no involvement of respiratory function or of the cranial nerves. One week after his admission to hospital the spinal fluid contained 11 leucocytes per cubic millimetre, and the protein content was 220 milligrammes per 100 millilitres. Four weeks later there were no cells found in the fluid and the protein had fallen to 100 milligrammes per 100 millilitres. A final examination after a further three weeks revealed 13 lymphocytes per cubic millimetre, and a protein content of 60 milligrammes per 100 millilitres. After his discharge from hospital recovery was complete.

The present incident began 36 hours before his admission to hospital with paræsthesiæ in the feet and legs; 24 hours prior to his admission to hospital the patient was unable to stand on his toes and, during the course of that day, walking became progressively more difficult. The paræsthesiæ spread up to the level of his groins, and tingling was noticed in the fingers of both hands. There was at no time any pain. Six weeks previously he had had a cold, but otherwise there was no relevant past history. There had been no vaccinations or injections apart from a Mantoux test at school within the two months prior to his admission to hospital.

On examination of the patient, the radial vessel walls were found to be palpable, the retinal arteries were rather tortuous and the blood pressure was 150/100 millimetres of mercury. There was no neck stiffness and the cranial nerves were normal. The cough was weak. There was weakness of all muscle groups of the upper limbs, most marked in the shoulder muscles, the muscles on the right side being slightly weaker than on the left. Weakness of all muscles of the lower limbs was gross, especially at the hips. The tone was flaccid, all reflexes were absent and plantar responses were flexor. Superficial sensation was subjectively diminished in the fingers and objectively impaired in the toes; the patient did not appreciate sensation normally anywhere below the knees. Joint position sense was diminished in the toes, and vibration sense was absent up to the iliac crests.

Spinal fluid examination on the day of his admission to hospital revealed one polymorph and 70 red cells per cubic millimetre, the latter thought to be due to trauma at lumbar puncture. The protein content was 40 milligrammes per 100 millilitres, the colloidal gold curve was 0011110000 and all the other findings were normal. Two days later the lower limbs were totally paralysed, shoulder movements were completely absent and the power of the hand grip was extremely weak. By the fourth day it was evident that the chest expansion was diminished, the cough was

feeble and the patient complained several times of difficulty in breathing. Later that day swallowing became impaired and a gastric tube was passed, but this appeared to excite excessive pharyngeal secretions which could not be swallowed, and, on the evening of the fifth day, tracheotomy was performed.

The paræsthesiæ had extended during this time from the thighs up to the chest and from the fingers to the shoulders. Apart from difficulty in swallowing there was no other evidence of cranial nerve involvement. The bladder was distended and a catheter was inserted for several days, but urinary infection occurred and it was removed, adequate evacuation being obtained with the aid of manual expression. During this initial period the diastolic blood pressure was several times recorded as 110 millimetres of mercury.

Intermittent positive pressure respiration was commenced immediately after tracheotomy because of subjective difficulty in breathing. At first it was utilized only for short periods, but, after 24 hours, the patient needed the machine constantly in operation. The machine was the Bennett's Pressure Breathing Therapy Unit, which requires some respiratory effort on the part of the patient unless it is operated by hand. The patient's inspiratory effort is sufficient to activate the machine, which then blows an air-oxygen mixture into the lungs until a pre-set pressure is reached, when it cuts out and allows expiration to occur passively.

After the institution of I.P.P. respiration the blood pressure and the blood bicarbonate levels returned to normal. The machine was in continuous use for the first week, and during the following eight or nine days progressively longer periods of weaning from the respirator were encouraged until it could be discontinued completely. By this time the chest expansion, undetectable when tracheotomy was performed, had increased to one and a half inches.

On the third and fourth days of I.P.P. respiration there were two incidents of pulmonary atelectasis with obvious shift of the mediastinum. These were rapidly overcome with postural drainage and percussion, the apex beat regaining its position within half an hour. Vigorous physiotherapy avoided other incidents of this nature, although on one occasion bronchoscopy was needed to relieve obstruction.

In the two or three weeks which followed the termination of I.P.P. respiration chest expansion steadily increased to three inches, and finally movement was noted in the proximal muscles of the upper limbs, and weak flexion became possible in the hips. Muscle power has progressively improved, but, at the present time (12 weeks from the onset), there is as yet no sign of the return of reflexes.

A further spinal fluid examination five weeks after his admission to hospital showed a protein content of 150 milligrammes per 100 millilitres, no increase in the number of cells and a colloidal gold curve of 4442222210.

The course was apyrexial apart from fevers clearly related to the pulmonary complications. The Paul Bunnell test, Wassermann test and liver function tests yielded negative results. Blood examination revealed nothing of note except in the fifth week, when a considerable eosinophilia was present. Prednisone, 20 milligrammes a day, was given for the first four days and then increased to 40 milligrammes a day, but the disease continued to progress.

Discussion.

We regard this case as an example of the Landry-Guillain-Barré syndrome. The onset was afebrile, and the paralysis developed slowly over the period of one week. Pain, which may be acute in poliomyelitis, was absent, paræsthesiæ were marked, and objective sensory loss was definite. The distribution of the weakness was symmetrical, and the proximal parts of the limbs were more severely affected, the tendon reflexes being diffusely lost from the beginning. The absence of an initial spinal fluid pleocytosis also helps to distinguish the case from conditions due to direct infection of the neuraxis, and the albumino-cytological dissociation found after five weeks is very suggestive of the Guillain-Barré syndrome. These features are not common in poliomyelitis.

Such details as are available of the attack six years prevously are also very suggestive of this syndrome. Again symptoms evolved over a period of about two weeks—far too long for poliomyelitis—and were unaccompanied by fever or general upset; there were paræsthesiæ; the distribution again was symmetrical and involved predominantly the proximal muscles in the arms. At the end of the second week there was a marked rise in cerebro-spinal fluid protein levels without an increase in the number of cells, and the eventual recovery was complete.

We have been able to find in the literature only one report of a recurrence of this syndrome, although we have had several verbal reports of well authenticated recurrences. Weigner (1948) reports the case of a woman, aged 60 years, who, 24 hours after a sore throat, developed paræsthesiæ and an ascending paralysis progressing to respiratory paralysis. Thirty years previously she had developed paræsthesiæ and an ascending paralysis of the lower limbs after a cold. The possibility of recurrence in this syndrome is of importance in bringing it into line with the group of diseases discussed earlier, which are possibly hypersensitivity reactions. Miller and Gibbons suggest as evidence against the theory of direct viral invasion in this group the relationship to previous non-specific infection, the absence of pleocytosis, the inconstancy of meningism and fever and the apparent failure to develop clinical immunity contrary to what may be expected to occur in viral infections. However, it must be remembered that poliomyelitis may recur owing to infection with another strain. Recurrences of the syndromes of this group of hypersensitivity diseases are rare after acute specific fevers and are usually noted in connexion with non-specific infections, particularly those of the upper respiratory tract. This type of infection causes little immunity and is liable to recur and set in motion a further antigen-antibody reaction with a recurrence of the neurological manifestations. If these hypotheses are valid, it is surprising that recurrences of the Landry-Guillain-Barré syndrome have not been reported more often.

Our patient was hypertensive and had tortuous retinal arteries when first seen and prior to the onset of respiratory insufficiency. Hypertension is extremely common in patients with bulbar and respiratory poliomyelitis, and it is usually due to hypercapnia. However, in a few it is persistent without relation to hypercapnia and may reach high figures. This type may be reversible with reversible fundal changes and is probably due to a central virus lesion (Debre *et alii*, 1955). These observations are of interest in view of the very high incidence of malignant hypertension (20%) in the Guillain-Barré syndrome reported by Haymaker and Kernohan (1949). In our case the hypertension rapidly disappeared after artificial respiration had been instituted, although there had been no apparent respiratory insufficiency when the patient was first observed.

Finally we would like to comment on the value of the Bennett's respirator in cases in which respiratory paralysis is not complete. The inspiratory pressure must be determined and is usually set between 10 and 15 centimetres of water. Thus the depth of respiration depends upon the setting on the machine. The inspiratory phase of the respirator is activated by the patient's own inspiratory effort, and thus the rate of respiration is governed entirely by the patient's own respiratory centre. In this way the risk of hyperventilation or hypoventilation, present with the entirely mechanical respirator, is very much lessened, although the blood bicarbonate level must be observed frequently in case the centre itself should be depressed and not be capable of responding fully to carbon dioxide retention.

Summary.

A case of Landry-Guillain-Barré syndrome progressing to respiratory paralysis is reported. A previous though milder attack had occurred six years earlier.

The present knowledge of the syndrome is summarized, and the ætiology and the significance of recurrence are discussed.

The treatment of respiratory paralysis is reviewed, and reference is made to a type of respirator of value for patients whose respiration is only partially paralysed, which permits them to regulate their own respiratory rate.

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Reviews.

Recent Advances in Urology. By Howard G. Hanley, M.D., F.R.C.S., with the assistance of specialist contributors; 1957. London: J. and A. Churchill, Limited. 8" x 5½", pp. 280, with 83 illustrations. Price: 30s. (English).

THE "Recent Advances" series has been favourably known for many years, and this recent volume makes a welcome addition in the progressive subject of urology. It is essentially a practical work, dealing with the clinical aspects in which new data are accumulating or in which recent advances have occurred, and does not stress additions to scientific knowledge. With the exception of two chapters, it is written by practising surgeons for surgeons.

However, the first chapter on medical problems in urology, written by A. R. Harrison, is one of the most useful in the book. It deals with the physiology of the kidneys and the body fluids, including the treatment of abnormal states, and with special problems in urology such as renal failure.

There is a brief section on radiology of the genito-urinary tract with the main emphasis on the newer opaque media in use, and on aortography, both abdominal and femoral. Abdominal compression, so beloved of the radiologist in excretion urography, is, in conformity with the ideas of nearly all urologists, condemned except in special cases.

The chapter on conservative renal surgery is excellent and gives a clear account with diagrams of the present favoured methods of treating hydronephrosis. Methods of drainage and splinting are discussed, but the recent tendency to omit these is not mentioned.

The different methods of prostatectomy are mentioned briefly and osteitis pubis in some detail, its predominance following retropubic prostatectomy being noted. A separate chapter is devoted to perurethral prostate resection. It is good, but the reader is left with the impression that the cold punch instrument, as used by the author, is preferable—an opinion shared by very few in this country or in the United States. It is interesting to see that Harris's original prohibition of post-operative bladder irrigations is now finding advocates in the northern hemisphere.

Prostatic cancer is well covered, as also are bladder tumours. The present state of urinary diversion is summarized, and other chapters include the subjects of urinary lithiasis, tuberculosis, the adrenals and subfertility. Unilateral renal disease with hypertension is not mentioned, but packed into this small volume is a large amount of very up-to-date urology.

At the end of each chapter is listed a wide range of references to recent literature, and there is no doubt that the author has produced something of great value, not only to post-graduate students but also to urologists generally.

Biochemical Investigations in Diagnosis and Treatment. By John D. N. Nabarro, M.D., F.R.C.P.; Second Edition; 1958. London: H. K. Lewis and Company, Limited. 7¾" x 5¼", pp. 311, with four illustrations. Price: £1 5s. (English).

THE second edition of Nabarro's useful book is very welcome. It deals with the clinical evaluation of biochemical tests within the scope of a reasonably well-equipped hospital laboratory. The author has constantly in mind the practicability of the various tests that he discusses. He does not consider methods except where the cooperation of the clinician may be required in their performance.

Only minor alterations have been introduced. These are concerned mainly with the blood proteins, including hæmoglobin, and with the steroid hormones. The over-all size of the book remains unchanged. A few pages have been gained for the text at the expense of the indices (and the convenience of the reader) by a somewhat ruthless elimination of subheadings.

This book remains an essential aid both to the clinician who makes use of biochemical tests and to the laboratory worker who performs them.

Recent Advances in Obstetrics and Gynæcology. By Aleck W. Bourne, M.A., M.B., B.Ch., F.R.C.S., F.R.C.O.G., and Leslie H. Williams, M.D., M.S., F.R.C.S., F.R.C.O.G.; Ninth Edition; 1958. London: J. and A. Churchill, Limited. 8" x 5", pp. 356, with 78 illustrations. Price: 38s. (English).

THIS volume of "Recent Advances" has reached its ninth edition. It measures up to the high standards set by its precursors and is perforce almost completely changed rather than revised. Only five chapters of the last edition are retained and modernized, while seven new ones have been introduced to survey much modern work.

The obstetric pelvis is discussed from an historical angle, and, in the treatment of contracted pelvis, the importance of uterine function is stressed above mere anatomical measurements. The action of uterine stimulants is summed up in a very complete survey and a considered treatment offered for incoordinate uterine action. A good section on lactation includes a résumé of the physiology, and sets out ideas for the treatment of deficient lactation by mechanical means, by hormones or by chemical agents. In a section on anæmia in pregnancy and the puerperium contributed by L. Steingold, consultant pathologist to St. Andrews Hospital, the latest trends, in both knowledge and therapy, are admirably reviewed.

Erythroblastosis has undergone many changes in concept during the last few years, and these are well covered from the point of view of history, pathology and treatment. The discussion is mainly practical, but consideration is given to Fisher's triple allelomorph theory and to the genetic factors involved in the inheritance of the Rhesus system of antigens. Exchange transfusion is rightly stressed as the treatment of choice, but no mention is made of the use of Rh-positive blood, which in some hospitals is the routine method of treatment.

Among the gynæcological subjects, an excellent discussion is given on the vexed question of "functional" uterine hæmorrhage, which is defined as abnormal hæmorrhage in the absence of pathological conditions which can be appreciated clinically. A survey of the accepted English treatment is covered in two chapters on cancer of the cervix and cancer of the uterine body. As regards the former, it is interesting to note the changing views of the authors, who advocated radium treatment exclusively in their sixth edition.

radical surgery in their seventh edition, and now, in this ninth edition, a combined approach based on cytological prognosis.

Blood coagulation defects are discussed with their chemistry and mechanism of clotting. The use of fibrinogen and plasma is outlined. Intravascular thrombosis and pulmonary embolus are treated by the conservative English methods with anticoagulants, but the Boston point of view, which favours venous ligature, is not neglected. Lumbar sympathetic block is strongly advocated for phlegmasia alba dolens.

One may disagree with such dogmatic statements as that "an old-fashioned postero-lateral episiotomy is thoroughly bad", because this method has a place when only a moderate episiotomy is required. Anterior vaginal hysterotomy to search for a possible uterine polypus, and utriculoplasty, instead of hysterectomy, are not much favoured in this country. However, on the whole, this book presents a fair picture of all that is best in English obstetrics and gynæcology today, within its terms of presenting recent advances in these subjects. In this it succeeds admirably, and it can be confidently recommended to teachers, specialists and those doing post-graduate study in obstetrics and gynæcology.

Methods of Biochemical Analysis. Edited by David Glick; Volume IV; 1957. New York and London: Interscience Publishers, Incorporated. 9" x 6", pp. 372, with nine illustrations. Price: $8.50.

Methods of Biochemical Analysis. Edited by David Glick; Volume V; 1957. New York and London: Interscience Publishers, Incorporated. 9" x 6", pp. 512, with many illustrations. Price: $9.50.

THESE two volumes continue an invaluable series of reference articles on authoritative methods, procedures and techniques for the determination and assaying of biologically important systems. This is a highly technical series of handbooks for laboratories and investigators who want to know the best and most accurate procedures, and, if possible, a comparison of methods where less expensive or less difficult alternatives exist. There is no systematic "annual coverage". Particular methods or categories of method are considered as and when the experts consider that this is suitable or that a good review will be most valuable to workers in the field.

In Volume IV the topics are: determination of carotene; determination of vitamin *A*; determination of 17,21-dihydroxy-20-ketosteroids; the measurement of polyunsaturated fatty acids; the assay of sulphatases; the pH-stat and its use in biochemistry; the determination of serum acid phosphatases; the determination of amino acids by use of bacterial amino-acid decarboxylases; determination of succinic dehydrogenase. In Volume V the topics are: assay methods for cholinesterases; biological standards in biochemical analysis; α-keto acid determinations; microdetermination of cobalt in biological materials; activation analysis and its application in biochemistry; contamination in trace element analysis and its control; chemical determination of œstrogens in human urine; the infra-red analysis of vitamins, hormones and coenzymes.

These volumes contain excellent bibliographies on each topic, and each volume carries a cumulative index of the topics in the entire series. They are basic material for the research laboratory and reference library.

Notes on Books.

The Year Book of Neurology, Psychiatry and Neurosurgery (1957-1958 Year Book Series). Neurology, edited by Roland P. Mackay, M.D.; Psychiatry, edited by S. Bernard Wortis, M.D.; Neurosurgery, edited by Oscar Sugar, M.D.; 1958. Chicago: The Year Book Publishers. 7¼" x 5", pp. 624, with 104 illustrations. Price: $8.00.

ALL three sections of this Year Book show evidence of the activity and progress current in the respective fields. In the introduction to the section on neurology, the editor, Roland P. Mackay, comments: "Neurologic research is plentiful and rich. In no field of medicine is the restless energy of investigation so active, promising increased understanding and felicity." The resultant abundant literature he has briefly surveyed in his introduction; then he presents it in abstract form in sections dealing with anatomy, physiology, pathology, infectious diseases, vascular disorders, tumours, degenerative diseases, metabolic disorders, trauma, convulsive disorders, exogenous toxins, neuropathies and diagnostic and therapeutic methods.

The introduction to the section on psychiatry, which is edited by S. Bernard Wortis, has several unusual features, including a list of some of the newer drugs used in psychiatric practice, with a table showing the range of the various treatments, as well as lists of some of the more important reports of conferences related to psychiatry, papers not abstracted but recommended for careful reading, and interesting books. The abstracts chosen for this section are grouped under the headings of general topics, psychodynamic studies, psychophysiologic studies, experimental psychiatry, psychosocial studies, child psychiatry, mental deficiency, organic disorders, paroxysmal convulsive disorders, schizophrenia and affective disorders, psychoneuroses and psychosomatic disorders, miscellaneous clinical syndromes, military neuropsychiatry, medico-legal psychiatry and therapy.

The third section, under the editorship of Oscar Sugar, contains annotated abstracts of articles on neurosurgery in the following groups: diagnostic techniques, congenital and perinatal disorders, infections, trauma, intracranial vascular disease, brain tumours, pituitary gland, spinal cord and intervertebral disk lesions, the sympathetic nervous system, the peripheral nerves, pain problems, convulsive disorders, surgery of involuntary movements, psychosurgery and miscellaneous.

Proceedings of the Sixth International Congress of the International Society of Hematology, Boston, August 27-September 1, 1956. 1958. New York: Grune and Stratton. 10" x 6¾", pp. 952, with many illustrations. Price: $25.00.

THIS formidable volume contains the Proceedings of the Sixth International Congress of the International Society of Hematology, held in Boston from August 27 to September 1, 1956. Some four hundred papers were presented to this congress, and they nearly all appear here, either complete or in summary form. They are grouped into seven sections: leukæmia, 79 papers; nucleonics, 61 papers; spleen and hypersplenism, 30 papers; hæmorrhagic disorders, 84 papers; anæmia, 83 papers; immunohæmatology, 40 papers; miscellaneous, eight papers. The papers come from nearly all over the world, and the contributors include many people eminent in their own field. The volume will thus be of great interest to all who are concerned with the progress of hæmatology.

Annual Review of Medicine. Edited by David A. Rytand and Associate Editor William P. Creger; Volume IX; 1958. Palo Alto, California, U.S.A.: Annual Reviews, Inc. 8½" x 5½", pp. 540. Price: $7.50, post paid.

THIS is one of the best books of its kind. It contains a series of critical reviews of current thought and advances in various fields of medicine, with the emphasis on the scientific approach to clinical medicine. A new and unusual feature is a chapter on "Soviet Medical Research: Some Recent Advances and Future Plans"; it contains a summary of selected results of research projects sponsored by the Academy of Medical Sciences, U.S.S.R., and published in a Russian journal in December, 1956, as well as a broad survey of the vast medical and biological literature which has only recently become available from the U.S.S.R. The rest of the book is made up of 27 sections, each dealing with a particular field of medicine.

Family Doctor. Published monthly by the proprietors, the British Medical Association, Tavistock Square, London, E.C.1. Sole agents for Australia and New Zealand: Gordon and Gotch (Australia), Limited. Subscription for twelve months: 20s. (sterling), including postage.

THE popular medical magazine *Family Doctor*, published by the British Medical Association in England, continues to appear each month. It is consistently interesting and attractive, presenting sanely the medical information that the layman nowadays looks for. It is essentially a family magazine, of greatest interest perhaps to the mothers of young families, but its scope is very wide. For example, the issue of February, 1958, deals with smoking in a special booklet and in an article on how to give up smoking. The March issue has special articles for housewives, dealing with some of the problems of house management, and also contains a frank and useful article on "The Truth About Radiation". Among the topical and somewhat controversial subjects in the April issue are teenagers, hypnotism, epilepsy and sex instruction. The May issue has a series of articles on motoring topics. The June issue has enclosed a special

booklet on milk. The July issue presents a mixed bag of subjects, including freckles, suicide, Parkinsonism, and the first of a new series in which a woman doctor gives her first-hand experiences of having a baby. *Family Doctor* can be recommended to patients with confidence and should be in every doctor's waiting room.

Antibiotics Annual, 1957-1958. Edited by Henry Welch, Ph.D., and Félix Martí-Ibáñez, M.D.; 1958. New York: Medical Encyclopedia, Inc. Distributed outside U.S.A. by Interscience Publishers, Inc., New York and London. 10" × 6¾", pp. 1088, with many illustrations. Price: $12.00.

APPROXIMATELY 160 papers were presented at the fifth Annual Symposium on Antibiotics, held in Washington in October, 1957, together with panel discussions on the prophylaxis of rheumatic fever, host resistance and chemotherapy, and antibiotics as antitumour and antiviral substances. Published together, they make up a substantial volume, which will be of great interest to all who are concerned in this rapidly advancing field of medical science. A great many papers are too technical to interest the general reader, but this is no fault; the book is primarily for the specialists in this field.

Books Received.

[*The mention of a book in this column does not imply that no review will appear in a subsequent issue.*]

"Regional Ileitis", by Burrill B. Crohn, M.D., and Harry Yarnis, M.D.; Second Revised Edition; 1958. New York, London: Grune and Stratton. 8½" × 5", pp. 256, with 79 illustrations. Price: $7.25.

Incorporates the results of extensive experience since the first edition was published in 1949.

"Annual Review of Medicine", edited by David A. Rytand and Associate Editor, William P. Creger; Volume 9; 1958. Palo Alto, California, U.S.A.: Annual Reviews, Inc. 8½" × 5½", pp. 540. Price: $7.50, post paid.

A most useful guide to progress in the scientific aspects of medicine.

"Textbook of Obstetrics", by John F. Cunningham, M.D., M.A.O., F.R.C.P.I., F.R.C.O.G.; Third Edition; 1958. London: William Heinemann (Medical Books), Limited. 8½" × 5½", pp. 528, with 297 illustrations. Price: 40s. (English).

This book is intended primarily for students; in the present edition it has been completely revised and pruned, and new work has been added.

"Clayton's Electrotherapy and Actinotherapy: A Textbook for Student Physiotherapists", by Pauline M. Scott, M.C.S.P., T.E.T., T.M.M.G., with a foreword by F. S. Cooksey, O.B.E., M.D., F.R.C.P.; Third Edition; 1958. London: Baillière, Tindall and Cox. 8½" × 5½", pp. 457, with 207 figures. Price: 27s. 6d. (English).

Designed to cover the electrotherapy sections of the syllabus of both the preliminary and intermediate examinations of the Chartered Society of Physiotherapy.

"Treatment of Malignant Blood Diseases by Radioactive Phosphorus: Part I. Clinical Aspects", by Ingmar Bergström and Erik Lindgren; *Acta Radiologica*, Supplement 150; 1957. Stockholm: Acta Radiologica. 9¼" × 7", pp. 107, with 23 illustrations and 10 tables. Price: Sw. Kr. 25.

An account of the treatment of leukæmia with P^{32}. Eighty-eight patients are considered.

"Angionephrography and Suprarenal Angiography: A Roentgenologic Study of the Normal Kidney, Extensive Renal and Suprarenal Lesions and Renal Aneurysms", by Gunnar Edsman; *Acta Radiologica*, Supplement 155; 1957. Stockholm: Acta Radiologica. 9¼" × 7", pp. 141, with 67 illustrations and 18 tables. Price: Sw. Kr. 30.

A radiological study of the normal anatomy of the kidney and, to a limited extent, of its pathology, as these appear at renal angiography on clinical material. A comparison is made of the results with those from earlier post-mortem examinations.

"*Uber das Vorkommen von Hiatushernien und Kardia-Insuffizienz in Verbindung mit Pleuraschwarte*", by Otso Kuosmanen; *Acta Radiologica*, Supplement 153; 1957. Stockholm: Acta Radiologica. 9¼" × 7", pp. 76, with 19 illustrations and 22 tables. Price: Sw. Kr. 20.

A study in the occurrence of hiatus hernia and cardiac insufficiency in association with pleural thickening. The text is in German with short summaries in English and French.

"Treatment of Malignant Blood Diseases by Radioactive Phosphorus: Part II. Hematological Aspects", by Ingmar Bergström; *Acta Radiologica*, Supplement 150; 1957. Stockholm: Acta Radiologica. 9¼" × 7", pp. 98, with 69 illustrations. Price: Sw. Kr. 25.

Detailed findings from a Swedish investigation.

"Radiologic Examination of the Brain and Spinal Cord", by Erik Lindgren; *Acta Radiologica*, Supplement 151; 1957. Stockholm: Acta Radiologica. 9¼" × 7", pp. 147, with 178 illustrations. Price: Sw. Kr. 35.

The substance of a lecture delivered in 1955 under the auspices of the University of Minnesota.

"The Histological Distribution of Proteinase and Peptidase Activity in Solid Tumor Transplants: A Histochemical Study on the Enzymic Characteristics of the Different Tumor Cell Types", by B. Sylvén and H. Malmgren; *Acta Radiologica*, Supplement 154; 1957. Stockholm: Acta Radiologica. 9¼" × 7", pp. 124, with 19 illustrations and seven tables. Price: Sw. Kr. 30.

This work comes from the Karolinska Institutet, the Cancer Research Division of Radiumhemmet, Stockholm.

"Primary Tumors of the Pelvic Bones: A Roentgen Diagnostic Study of Eighty-Three Cases", by Carl Gustav Helander and Åke Lindbom; *Acta Radiologica*, Supplement 152; 1957. Stockholm: Acta Radiologica. 9¼" × 7", pp. 62, with 48 illustrations. Price: Sw. Kr. 25.

"The aim of this work is to provide the roentgen diagnostician with a survey of the various types of tumors occurring in the pelvic bones."

"Procedures for the Testing of Intentional Food Additives to Establish Their Safety for Use", World Health Organization Technical Report Series No. 144; 1958. Geneva: World Health Organization. 9¼" × 6¼", pp. 20. Price: 1s. 9d.

The second report of the Joint FAO/WHO Expert Committee on Food Additives.

"Home Conditions: A Sociomedical Study of 1066 Hospitalized Patients with Skin and Venereal Diseases", by Esbern Lomholt; a reprint from *Acta Dermato-Venereologica*; 1958. Copenhagen: Rosenkilde and Bagger. 10¼" × 6¾", pp. 100, with 42 tables. Price: Dan. Kr. 14.00.

The report of a study carried out in Denmark during the years 1950-1953.

"D. W. Winnicott, F.R.C.P. (Lond.): Collected Papers: Through Pædiatrics to Psycho-Analysis"; 1958. London: Tavistock Publications, Limited. 8½" × 5½", pp. 360, with illustrations. Price: 35s. (English).

The collected papers of a pædiatric physician who later was trained in psychoanalysis.

"Suspension Therapy in Rehabilitation", by Margaret Hollis, M.C.S.P., and Margaret H. S. Roper, M.C.S.P.; 1958. London: Baillière, Tindall and Cox. 8½" × 5½", pp. 232, with 112 illustrations. Price: 25s. (English).

This book is based on the work of Olive Frances Guthrie Smith.

"Textbook of British Surgery", edited by Sir Henry Souttar, C.B.E., D.M., F.R.C.S., and J. C. Goligher, Ch.M., F.R.C.S.; Volume III; 1958. London: William Heinemann (Medical Books), Limited. 9½" × 7", pp. 628, with 207 illustrations and two tables. Price: 105s. (English).

The third of four volumes in a notable modern surgical work.

"The Physiology of Learning", by W. Ritchie Russell, C.B.E., M.D., M.A., D.Sc., F.R.C.P.; 1957. Edinburgh: The Royal College of Physicians. 8½" × 5", pp. 28. Price not stated.

The Morrison Lecture for 1957.

The Medical Journal of Australia

SATURDAY, AUGUST 2, 1958.

THE PENSIONER MEDICAL SERVICE.

A NEW AGREEMENT between the Federal Council of the British Medical Association in Australia and the Commonwealth Government on the Pensioner Medical Service has come into force with effect from July 1, 1958. This brings to an end the anomalous situation, existing since October, 1955, in which the Pensioner Medical Service has been carried on in the complete absence of any agreement. The main features of the new agreement are that the fees payable to medical practitioners under the Service have been increased to eleven shillings for surgery consultations and thirteen shillings for domiciliary visits, and that the period of the agreement is to be two years. Where the medical practitioner attends a number of patients at the same place (other than at the patient's private residence) during the same visit payment for the attendances in excess of one will be made at the rate applicable to surgery consultations. The following amendment will apply to the payment for mileage: "Temporary headquarters established by a medical practitioner in an area other than that in which his permanent headquarters are established will be regarded as the surgery for the purpose of calculating mileage allowance, but no allowance will be payable for travelling between the permanent and temporary headquarters, except in emergency."

The increase in fees provided in the new agreement does not represent the amount requested originally by the Federal Council, but the agreement was entered into only after the matter had been referred to all Branches for their approval or otherwise. In all its representations to the Government in recent years the Federal Council has emphasized that appropriate fees under the Pensioner Medical Service should be twelve shillings and sixpence per consultation and fifteen shillings per visit. As these amounts represent a concessional reduction of approximately 40% on current private fees, it will be appreciated that the new agreement involves a very substantial concession; it will be seen also just how difficult it is to impress on the holders of the public purse what is the current value of a fair return for professional services. In this regard it is of interest to look back at the history of the Pensioner Medical Service, the main features of which were outlined by the General Secretary of the Federal Council in a document which was sent to Branches last year. When the Pensioner Medical Service was instituted in 1950, it was agreed between the Minister for Health and the Federal Council that the scope of the Service would be "that of the Common Form of Agreement between Medical Officer and Friendly Society Lodge, and such other services of a minor or special character as are ordinarily rendered in the surgery or in the home", and that remuneration of doctors should be at the rate of six shillings for a surgery consultation and seven shillings and sixpence for a domiciliary visit. These fees represented a concession amounting to approximately a 40% reduction of the fees then ruling in private practice. On this basis members of the Association were invited to join the scheme, and their response was such that the scheme has been working satisfactorily ever since. During the next five years the agreement was varied from time to time by further negotiations with the Commonwealth Government, and the fees were raised on several occasions because of the following features: (i) liberalization of the means test for pensioners, which resulted in large increases in the categories of pensioners; (ii) increases in the cost of living, with resultant increases in the costs of conducting medical practice. The last agreement with the Commonwealth Government in the matter of fees, which provided for amounts of ten shillings for a surgery consultation and twelve shillings for a domiciliary visit, expired on October 31, 1955. At that time the Federal Council, with the unanimous support of all the State Branches, was of the opinion that in any new agreement the rates should be twelve shillings and sixpence for a surgery consultation and fifteen shillings for a domiciliary visit. These rates represented a concession amounting to approximately a 40% reduction on the fees then ruling in private practice and were therefore entirely consistent with the original agreement of 1950. However, all attempts to negotiate a new agreement on the basis of these fees were unsuccessful. The Federal Government refused to increase the fees beyond the ten shillings and twelve shillings of the expired agreement, and the Federal Council declined to enter into a new agreement at those rates.

The members of the profession continued to supply a service to pensioners, and were paid at the existing rates; but no agreement existed, and it was a matter for speculation just how long such a curious situation could continue. The State Branches, while they were of the opinion that the profession should continue to work the Service, asked the Federal Council to continue its representations to the Government for an increase in rates for attendance. Accordingly, the Federal Council again made a request to the minister for an increase in fees in February, 1957, and again this was refused. Undaunted, the Federal Council at its meeting in August, 1957, resolved to persist in its efforts. Further negotiations were carried on, and by the time of the Federal Council meeting in February, 1958, it appeared that a compromise might be reached. The State Branches were further consulted on their views of what should be done if the Commonwealth Government offered an increase in rates less than that which was being asked for by the Federal Council. In the light of their replies it was then possible to reach an agreement with the Government when a firm offer was made for an increase in fees to eleven shillings and thirteen shillings.

Of the very few modifications of the Government's proposition sought and obtained by the Federal Council, the most important is the limitation of the agreement to a period of two years. It would be quite unwise to speculate what might happen at the end of those two years, but both

parties at least acknowledge that the agreement is to come up for review at that time. The whole story of the negotiation brings home to the medical profession in this country a lesson which our colleagues in Great Britain have learnt with bitterness and at much greater cost—that negotiations with governments and government bodies over fixed rates of payment are full of frustrations. It is clear that the less the profession is dependent upon government-fixed rates, the better off it will be.

Current Comment.

ARMY MEDICAL SERVICES IN MIDDLE EAST AND FAR EAST CAMPAIGNS.

THE varied conditions in which the Army Medical Services operate are well illustrated in the latest volume on the history of the Royal Army Medical Corps in the second World War.[1] From the depressing accounts of the loss of Hong Kong and Malaya, with the appalling conditions prevailing in the prisoner-of-war camps, it is a relief to turn to the successful campaigns in the Western Desert and North-West Africa. To lend further variety, there is a short account of the medical aspects of the occupation of Iceland and the Faroes undertaken by the British until the United States entered the war, in order to provide bases for naval escort groups and long-range aircraft.

The editor, Sir Arthur MacNalty, expresses his gratitude to those members of the Army Medical Services who during their prolonged and humiliating captivity continued to record, and with extraordinary ingenuity to retain, accurate and dispassionate accounts of their experiences for the future purpose in which they are now being utilized. He includes amongst those officers to whom he was particularly indebted in this regard Major Bruce Hunt, A.A.M.C. Adequate accounts of prisoner-of-war camps and labour conditions on the Thailand-Burma railway have already been published in the official accounts of other participants, and the editor particularly commends for consultation the official Australian account by the late Colonel Allan Walker, because of its comprehensiveness and wealth of detail; Sir Arthur MacNalty regards his own account as being supplementary to the Australian narrative with attention focused particularly on British Army personnel. It is well to be reminded from time to time of this supreme example of devoted service—the greatest achievement of the Australian Army Medical Corps.

In the account of the campaign in Libya, the events leading up to the Battle of Alamein and the medical arrangements for the actual engagement in which the Australian Ninth Division took an important part are described in considerable detail. From Alamein the Eighth Army fought its way through El Algheila and Buerat to Tripoli. The vast open areas of the Western Desert necessitated greatly increased mobility, with supply and evacuation lines ever increasing in length. Although from the Battle of Alamein onwards 2000 casualties were evacuated to base hospitals by air, patients frequently had a low priority for air transport, particularly at peak periods, when their need was greatest, and air evacuation was not adequately organized until the end of the campaign. It became necessary therefore to extend the use of mobile self-contained surgical units, which could open and close quickly and move swiftly over the desert to forward areas. Field surgical and transfusion units with field dressing stations and occasionally a mobile light section of a casualty clearing station, grouped in various patterns, provided a service of ever-increasing efficiency. There was ample scope for initiative and ingenuity in improvisation. In this area in 1942 penicillin was for the first time used in treatment of battle casualties and also of accidental injuries, which with increased use of armoured vehicles and of new weapons at times outnumbered those due to enemy action.

The campaign in North-West Africa followed the entry of the United States of America into the war. It was an attempt, successful in the issue, to afford indirect aid to Russia by eliminating the Axis forces in North Africa. The Eighth Army continued its victorious advance from the east, whilst a composite American, British and French force attacked from the west. The most serious medical problem here was control of malaria. Most of the coastal belt was highly malarious, as also were the valleys stretching inland. Benign tertian and malignant tertian were the forms most commonly encountered. In this area, as elsewhere, it required a serious reduction in the efficiency of the troops to convince senior combatant officers of the necessity to adopt universal preventive medication with mepacrine.

This "Operation Torch" was quite a hazardous venture, and the task of the D.D.M.S., First Army, was not made any easier by the fact that he had at times British, French and American medical units under command. At the conclusion of the campaign he wrote some "Reflections", which are included in this volume and deserve careful consideration. He mentions various defects in planning and organization, and suggests how they might be prevented. He was critical of the quality of medical officers allotted to him and writes:

> One point that emerged very clearly was the need for high calibre senior officers. The A.Ds.M.S. of L. of C. and base areas require the most careful selection as the whole Army is based on them. The apparently prevalent idea that these appointments are medical administrative backwaters should be discarded at once. Similarly with Os.C. general hospitals employed with Army. These are new units requiring rigorous administration coupled with extreme adaptability and are no place for the aged in mind or body. The units should be considered as field units and Os.C. and Os.C. divisions specially selected.

There is an extensive survey of the health of the Middle East force adopted from a report by two of the senior hygiene officers of the Command. In the force there were approximately a million men from three-quarters of the globe, fighting in areas where there was infinite variety of colour, religion, language, custom and civic development, with in most instances long-standing insanitation. The army health organization had a tremendous task to carry out in surveying and controlling all the manifold influences likely to impair or undermine the vigour, fitness, well-being or efficiency of the personnel of this vast force. In this important review of its activities the authors justly claim for the service a large contribution towards the ultimate success of the campaign, judging not merely from hospital admission rates, which were an improvement on those of any previous war, but from the positive picture of the health and vigour shown by the soldiers and from their successful achievements in adversity and in final victory.

Increasing evacuation of psychiatric casualties to the United Kingdom prompted the appointment in 1940 of a psychiatric consultant, available to all British services and to Dominion and allied contingents. He undertook a survey of the problem over the whole area and of psychiatry in the Eighth Army in particular. The fact that there were at the same time in one hospital patients of 28 different nationalities gives some indication of the complexity of his task. The difficult problems of the Army Psychiatric Service in the Middle East are discussed in a chapter in which it is strongly urged that all army medical officers should have more than a slight knowledge of psychiatry, both to facilitate early diagnosis and also to ensure the rejection of recruits and particularly of candidates for

[1] "History of the Second World War: United Kingdom Medical Series." Editor-in-Chief, Sir Arthur S. MacNalty, K.C.B., M.A., M.D., F.R.C.P., F.R.C.S. "The Army Medical Services: Campaigns", by F. A. E. Crew, F.R.S. Volume II: Hong Kong, Malaya, Iceland and the Faroes, Libya, 1942-1943, North-West Africa; 1957. London: Her Majesty's Stationery Office. 9½" × 5½", pp. 670, with many illustrations. Price: 84s. (English).

commissions who lack the necessary mental and emotional stability for field service.

A short account of army pathology and transfusion services in the campaigns under notice is full of helpful information, tactical and administrative, medical and technical. It deserved more space.

Professor Crew has in this volume maintained the high standard of Volume I. It will be read with keen interest by those medical officers who participated in the Middle East campaigns, but it has even greater value for those still serving in the R.A.A.M.C.

A CENTURY OF INTERNATIONAL OPHTHALMOLOGY (1857–1957).

IN view of the difficulties and embarrassments associated with a formidable language barrier, it is remarkable that for a whole century ophthalmologists throughout the world have contrived to meet together once in every four years to promote friendly social intercourse and to discuss new developments in their own highly specialized field of medicine. Since the first international congress of ophthalmologists was held at Brussels in 1857, representatives of over forty-six different countries have come together in this way. They have now allied themselves with a freshly constituted federal body, formed in Madrid in 1933, which has three main objectives: to reach a better understanding of immediate problems through personal contact with colleagues who have actually led the way in scientific and technical advances in the specialty; to devise new ways and means for the prevention of blindness; to reduce the still disturbing incidence of trachoma in whatever country fresh outbreaks may happen to occur.

To honour the founders of this virile international brotherhood and to commemorate the centenary of its origin, the distinguished London eye specialist, Sir Stewart Duke-Elder,[1] has writen an interesting and stimulating historical account of the activities of the various congresses from their inauguration to the present day. And here it should be noted that last year a delegation representing the Ophthalmological Society of Australia helped to celebrate a great occasion by attending the centenary meeting in Brussels.

A moving spirit in the first effort to call together outstanding authorities in the new specialty was the editor of a Belgian periodical devoted entirely to the subject. He realized the necessity for some concerted action to be taken by the leaders of the profession to check the spread of an incapacitating disease of the eyes known as *"l'ophthalmie militaire"*, which had come from Egypt and had reached epidemic proportions in western Europe after the Napoleonic wars and then spread rapidly among the civilian population. In an open letter to the profession he stressed the need for a fresh assessment to be made at the meeting proposed to be held at Brussels in September, 1857, of the new instrument invented by Hermann von Helmholtz seven years previously, the use of which was little understood and seldom applied in practice by members of the profession. The first meeting of congress was held under the presidency of S. L. Fallot, a recognized authority on trachoma; then, no doubt, it was emphasized that the ophthalmoscope was not a mere plaything, but promised assistance in the diagnosis of intraocular lesions and in the detection of systemic disease and might be helpful in estimating errors of refraction in certain tests for visual acuity.

The publication in 1857 of Helmholtz's "Physiological Optics" provided the stimulus which decided the world's most famous specialists to put their weight behind the movement for cooperation. Albrecht von Graefe unexpectedly turned up at the first meeting and gave an impromptu address on his new operative treatment for glaucoma by iridectomy. Other ophthalmologists of international repute who contributed conspicuously to the success of subsequent meetings were Frans Cornelius Donders of Utrecht, von Helmholtz, Argyll-Robertson of Edinburgh, Herman Snellen, Sir William Bowman, Treacher Collins of London, Jules Gonin of Switzerland, and more recently, the author of this short history, whose unselfish and tireless efforts in the cause are fully appreciated by his colleagues the world over. Although the normal rhythm of these helpful gatherings has been interrupted for varying periods by a succession of major political crises, they have done much to eliminate prejudices, to cement close friendships and to confer lasting benefits upon all mankind. Apart from its value in other directions, Sir Stewart Duke-Elder's monograph is a confirmation in itself that scientific collaboration on a world basis may be undertaken with success.

[1] "A Century of International Ophthalmology (1857-1957)", written at the request of the International Council of Ophthalmology by Sir Stewart Duke-Elder; 1958. London: Henry Kimpton Press. 8½" × 5", pp. 94, with illustrations. Price: 12s. 6d. (English).

GLAUCOMA DETECTION IN MEDICAL PRACTICE.

THE detection of glaucoma in its early stages is a problem which exercises the minds of ophthalmologists all over the world. Many surveys have been conducted using routine tonometry on all patients over 40 years of age and subsequently submitting all those with an intraocular tension of 25 millimetres of mercury or more to further examination.[1] Most surveys indicate that between 2% and 3% of patients so examined have glaucoma. The question whether the general practitioner should participate in the glaucoma detection programme has often been discussed, and the trend now is towards teaching the general practitioner the use of the tonometer with a direction that he refer all patients with a tension over 25 millimetres of mercury to the eye department of a hospital or to an ophthalmologist. A glaucoma detection programme, initiated in a teaching hospital in Tennessee,[2] is reported by Margaret E. Horsley and Henry Packer. Of 1210 patients tested, 49 were found to have unrecognized glaucoma. Ocular tensions obtained in the various out-patient clinics were recorded by a nurse who had received special training in this procedure. Any patient with a tension over 25 millimetres of mercury was referred to the eye clinic and rechecked by the resident medical officer in ophthalmology. Ocular tensions were also checked routinely by all medical students in the eye clinic. The results speak for themselves. With the increase in life span glaucoma is becoming more common, and failure to recognize the disease early can have disastrous effects. Horsley and Packer are of the opinion that routine tonometry should be made a part of every physical examination of persons over 40 years of age, even in the absence of eye complaints.

Awareness of the possibility that a patient may have glaucoma or be a potential candidate for glaucoma should also be remembered by physicians who undertake the use of antispasmodic drugs in patients over the age of 40 years. Warning of the danger of these drugs to such people is given by Cholst *et alii*.[3] Their recommendation is that the physician should take three steps to protect the patient in respect to glaucoma before prescribing such drugs: the history should be investigated for the presence of diagnosed glaucoma or a family history of glaucoma; an evaluation should be made of some of the subjective symptoms of glaucoma—namely, blurred vision, presence of haloes around lights, pain in or around the eyeball, difficulty with field of vision and discomfort with close work; finally, observation should be made for the presence of dilated pupils which react sluggishly, a shallow anterior chamber, a contracted visual field and a suspicion of raised intraocular tension. Of antispasmodic drugs tested, Cholst *et alii* found that dicyclomine hydrochloride ("Bentyl") is less likely than others to cause an increase in intraocular tension or to affect pupillary dilatation or accommodation.

[1] *Tr. Ophth. Soc. U. Kingdom*, 1957.
[2] *J.A.M.A.*, 1958, 166:1265 (March 15).
[3] *J.A.M.A.*, 1958, 166:1276 (March 15).

Abstracts from Medical Literature.

DERMATOLOGY.

Primary Omphalitis in an Adult.

A. B. KERN (*Arch. Dermat.*, March, 1958) reports an unusual case of primary umbilical sepsis in an adult male, aged 35 years. The patient complained of a foul-smelling discharge from the navel. Pain was never present. Physical examination revealed erythema and slight tenderness of the umbilicus without any definite induration. The patient was extremely hirsute with an especially heavy growth on the abdominal wall, extending down into the umbilicus. Welling to the surface of the umbilicus was a considerable amount of yellowish-green foul-smelling pus. Probing the depths of the umbilicus revealed a mass made up primarily of broken hair. After the removal of the hair and pus from the umbilical cavity a dose of 75*r* was given to the area, and compresses with a warm solution of zinc and copper sulphates and an antibiotic ointment were prescribed. A few days later additional hair was removed from the depth of the umbilicus. After this, the discharge ceased and the erythema disappeared. The patient reported seven months later that he had remained asymptomatic. The author reviews a series of similar cases reported in the literature, a number of which had originally received a variety of misdiagnoses such as dermoid cyst, tuberculosis, fistula and carcinoma. One case has been recorded in which a patient was subjected to partial gastrectomy owing to lack of recognition of this condition.

Hypertrophic Lichen Planus with Epidermoid Carcinoma.

B. B. BRENNAN AND R. TEPLITZ (*Arch. Dermat.*, March, 1958) report the case of a patient with chronic hypertrophic lichen planus of 15 years' duration who developed epidermoid carcinoma at two separate sites within one of the plaques of lichen planus. The factors responsible for this unusual combination of lesions are unknown, and the theoretical possibilities are reviewed. The development of epidermoid carcinoma in patients with chronic hypertrophic lichen planus, although rare, suggests that periodic examination of such patients is important.

Pustular Psoriasis.

J. T. INGRAM (*Arch. Dermat.*, March, 1958) discusses three chronic pustular eruptions of the hands and feet which are peculiarly resistant to treatment and which merit attention as a group rather than as independent affections. They are described under the titles of acrodermatitis continua (or pustars), pustular bacterid and pustular psoriasis. They are all forms of persistent pustular pompholyx, and are perhaps only variants of one distinctive clinical entity. These affections are four times more common in psoriatic patients than in others. The author considers that they are combined eczematous and psoriatic reactions and like so many other combinations owe their recalcitrance to that fact. The presence or absence of staphylococci in the lakes of pus is of no significance. Psoriatic and eczematous components of the reaction can be recognized both histologically and clinically. Treatment other than local measures is not beneficial, tar and a sulphonated bitumen preparation resembling ichthyol being the most effective applications. Occasionally the affection is seen as a generalized reaction and may prove fatal. Females are more subject to the affection than males, in the proportion of two to one.

An Unusual Syndrome of Ulcers, Vesicles and Arthritis.

S. AYRES, JUNIOR, AND S. AYRES III (*Arch. Dermat.*, March, 1958) describe four cases of pyoderma gangrenosum in which there was an association of ulcers, vesicles and arthritis. All four patients showed typical chronic recurrent spreading ulcers with raised purplish borders and an erythematous halo. All four patients had fairly severe chronic arthritis, and in three of these arthritis was of the rheumatoid type. None of these four patients had any evidence of ulcerative colitis or other debilitating disease. Two of the four patients had vesicular eruptions resembling dermatitis herpetiformis, and a third suffered from crops of "blood blisters". All four patients were benefited but not cured by sulphapyridine, although one patient could not take it in adequate amounts because of nausea. The benefit included the improvement of vesicular lesions as well as ulcers, and in one case there was also improvement of the arthritis. The authors agree with other observers who believe that this disease is not primarily a local infection and is not necessarily dependent upon an underlying debilitating condition such as ulcerative colitis or other infection.

Kerato-Acanthoma.

J. M. DE MOROGAS, H. MONTGOMERY AND J. R. MCDONALD (*Arch. Dermat.*, April, 1958) discuss the distinctions between kerato-acanthoma (molluscum sebaceum) and squamous cell carcinoma. The former is a skin tumour which after a period of rapid growth undergoes spontaneous involution. The close resemblance between kerato-acanthoma and the "button" type of squamous cell carcinoma makes clinical distinction between them difficult or impossible. During the authors' study it became apparent that distinction on pathological grounds is impossible in early kerato-acanthoma. Clinical factors which may point towards Kerato-acanthoma are: (i) the skin surrounding the lesion usually appears normal; (ii) the rapid growth of a kerato-acanthoma in the short period of one or two months contrasts with the slower growth of a low-grade carcinoma; (iii) there is no involvement of the regional lymph glands, in spite of the fast growth of the primary lesion; (iv) once the lesion has attained its maximal size, it does not progress further, remaining unchanged for a period of time and hence lacking the tendency of continued progression of a true malignant growth; (v) if the tendency to involute is already apparent, the diagnosis is quite obvious. In contrast, the clinical features of low-grade squamous cell carcinoma are: (i) the pre-epitheliomatous changes of the surrounding skin; (ii) the slow rate of growth; (iii) the presence of true ulceration; (iv) the tendency to progress indefinitely; (v) involvement of the regional lymph nodes.

Skin Manifestations of Chronic Acidosis.

E. G. OLMSTEAD AND J. H. LUNSETH (*Arch. Dermat.*, March, 1958) describe five cases of dermatitis associated with chronic renal disease. All patients suffered from some degree of chronic acidosis consequent on their renal lesion. All patients showed thickening of the skin, dryness, scaling and loss of body hair, particularly over the extremities. The most striking histological finding was the occurrence of an increase in elastin fibres in the papillary layer of the skin and in the perifollicular regions, which seemed to be correlated with the degree and duration of the acidosis. The degree of skin involvement was clinically and pathologically more closely related to the degree of acidosis and the duration of the acidosis than any other single chemical abnormality of the serum. Clinical improvement of the skin lesions with loss of itching and regrowth of hair occurred in two patients with chronic acidosis who had been treated with sodium bicarbonate for five to eight months. In one of these cases biopsy of the skin after treatment with sodium bicarbonate showed a return of the histological picture to normal.

Pigeons as a Source of Acariasis.

G. A. DE OREO (*Arch. Dermat.*, April, 1958) reports 14 cases of acariasis due to *Dermanyssus gallinæ* with the pigeon acting as the source of the mite. The pigeon should be suspected as a possible cause of pruritic dermatoses occurring in the spring and summer months, and in which the ætiology is obscure.

Subcorneal Pustular Dermatosis.

C. H. GREENBAUM AND J. B. LEE (*Arch. Dermat.*, May, 1958) state that Sneddon and Wilkinson, in 1956, described a process resembling dermatitis herpetiformis clinically, but with differences which convinced them that they were dealing with a hitherto undescribed entity. The authors present a case which they believe identical with Sneddon's. Sneddon and Wilkinson described a series of seven cases of a chronic recurrent pustular eruption clinically resembling dermatitis herpetiformis. The biopsies, however, revealed the pustules to be subcorneal in location, a phenomenon not at present generally recognized as occurring in dermatitis herpetiformis. Sneddon found that most of their patients did not respond to sulphapyridine, but sulphone ("Dapsone") was sometimes effective. Other antibiotics had no effect. The authors disagree with Hellier's statement that the condition is a generalized form of pustular bacterid.

Treatment of Warts with Cantharadin.

W. L. EPSTEIN AND A. M. KELIGMAN (*Arch. Dermat.*, May, 1958) state that, because of the special ability of cantharadin to disorganize epidermal cells, they decided to explore its use as a chemotherapeutic agent in warts. For topical treatment cantharadin is prepared as a 0·7% solution in equal parts of acetone

and flexible collodion, the cantharadin being first dissolved in acetone. The solution should be kept in a glass-stoppered bottle. A glass rod is used for applying the solution, and the application should be confined to the wart itself. Paring or other treatment is unnecessary. As the volatile components evaporate a thin white membrane forms. A small piece of plastic adhesive slightly larger than the wart is applied. Unless the lesion is occluded in this manner, the acantholytic activity of cantharadin is not realized. The preparation is kept in place by covering it with a "Bandaid" or gauze dressing; plain adhesive plaster should not be used for this purpose because cantharadin tends to spread under the plaster. Dressings for plantar warts must be more securely fixed by additional strips of adhesive plaster. The dressing should be allowed to remain in place until the patient's return in seven to 10 days. A frank blister usually forms within 24 hours, but individual responses are variable. Larger warts may be the sites of subclinical blisters, taking on a whitish, soggy, macerated appearance not unlike the effects of salicylic acid plaster. Sometimes a hard callus-like button forms. One treatment is often enough, but when necessary, repeated applications should be made at weekly intervals so long as warty tissue remains, though this should be deferred if there is much inflammation. Most patients note little discomfort, but the site may become tender, sometimes extremely so, for two to six days. When there is marked tenderness and pain within 24 hours, relief may be obtained by removing the dressing, puncturing the blister, and soaking the part for a few days. Only one or two lesions should be treated at the first sitting until the reactivity of the patient is known. The advantages of cantharadin are the absence of residual scarring, simplicity of application, and that it is not time-consuming. Cantharadin is cheap and stable. The main disadvantages are pain, tenderness and discomfort in certain persons. It should be noted that the prescription is for cantharadin, not cantharides. Cantharadin seems a superior therapy for periungual warts. It is not recommended for mosaic warts.

UROLOGY.

Clinical Significance of Hæmaturia.

C. C. HIGGINS (*J.A.M.A.*, January 18, 1958), in a review of the clinical significance of hæmaturia, points out that hæmaturia can occur with systemic disease, with intrinsic disease of the genito-urinary tract, or with disease localized in other parts of the body. The nature of the underlying causes varies strikingly with age. Between the years of one and five cystitis is the most common cause; between five and 10, glomerulonephritis; from 11 to 40, inflammatory lesions, with cystitis and pyelonephritis predominating in both sexes; in men aged from 41 to 60 years, various vesical neoplasms are the most frequent cause; from 61 to 70 years benign or malignant forms of prostatism predominate. These results confirm the gravity of hæmaturia as a sympton. A practitioner confronted with it should make sure that he is not dealing with a serious organic lesion or a malignant tumour. An immediate skilled urological survey is mandatory. In 1925 Kretschmer made a review of 933 consecutive cases of hæmaturia and found that in just on 40% of these the source of bleeding was the kidney. The next largest group were diseases of the bladder, and about three-quarters of these were vesical neoplasms. Debenham, in 1933, reviewed 742 cases of hæmaturia and noted that papilloma or carcinoma of the bladder was the commonest cause in men, while inflammatory lesions were the commonest cause in women.

Quick Relief of Renal Colic.

P. VAN DOOREN (*J. Urol.*, December, 1957) suggests a simple method for immediate relief of renal colic. The standard treatment of morphine injection, sometimes with atropine, requires considerable time to take effect. During that time it is sometimes impossible to get a good history, or properly to examine the patient. In areas of cutaneous referred pain in visceral disease there is also an area of hypersensitivity which can be disturbed by lightly scratching the skin with a pin. In renal colic there is a wide, ribbon-like area running around the flank from the costo-vertebral angle to the groin. After the limits of the area have been demarcated by testing with a pin, it is marked with ink, and multiple injections of one-tenth of a millilitre of "Novocain" (1%) are made intracutaneously. The little injections are evenly spaced at about one centimetre apart, but the pattern is not important. The sharp colicky pain disappears at once, and the patient, who has been rolling in agony, suddenly becomes quiet and relaxed. There remains only a mild dull ache, and it becomes possible to examine the patient and to get him to lie still on an X-ray table for the necessary diagnostic pictures. Anti-spasmodics can now be given to relieve the spasm of the ureter or pelvis and further conservative treatment or operation follows, according to indications.

Prognosis in Renal Carcinoma.

E. W. RICHES (*Brit. J. Urol.*, February, 1958) discusses the prognosis of adenocarcinoma of the renal parenchyma after nephrectomy. In a large collected British series totalling over 1000 cases, it was found that about one-half of the patients survived for three years, about 40% for five years, and only 20% for 10 years. The factors found of most value in estimating prognosis are (i) the histological grade of the neoplasm, (ii) involvement of the renal vein, (iii) invasion of lymph nodes, (iv) local extension of the growth, and (v) the presence of metastases. These factors have been considered in 84 personal cases; 76 of these were subjected to nephrectomy, the others being inoperable. The histological grade of the tumour is the most important factor, and involvement of the renal vein has a serious adverse influence. Surgical excision must be early and radical to give much chance of permanent success. The operative mortality was 8%. Twenty-five of the 76 patients were living five to 10 years after operation. Of the 76 patients, 54 were operated on five or more years ago, and these form the basis of survival tables. The five-year survival in grade I (well differentiated type) was 71%. In grade II (tubules or papillary processes not well formed) survival was 39%. In grade III (no attempt at tubular or papillary forms, marked variation in staining of cells, and considerable mitotic activity) survival was only 25%. Neither the size of the tumour nor its gross appearance gives any clue to the histological type. A final important factor is that X-ray therapy, either before or after operation, increases the survival rate.

OPHTHALMOLOGY.

Report on the Diathermy Treatment of Retinoblastoma.

E. B. DUNPHY (*Am. J. Ophth.*, April, 1958) reports on the use of diathermy in the treatment of retinoblastoma. Eight cases are reported. The sclera is bared over the lesion, the tumour must be accurately localized, and it is then ringed with diathermy under ophthalmoscopic control. When the tumour is completely surrounded two-millimetre perforating electrodes are used in the centre of this area. Usually, a 30 milliampere current is used and the needles are allowed to remain in for eight to ten seconds. This causes swelling of the retina and the appearance of hæmorrhages on the surface of the tumour. In the next few days the tumour takes on a grey appearance, hæmorrhages become more extensive, and vitreous opacities appear. Then the tumour begins to shrink and hæmorrhages become less. Eventually, a flat, scarred atrophic area is left surrounded by pigment. The vitreous opacities diminish. This method is not applicable for tumours near the optic nerve or for very large tumours protruding into vitreous.

Peripheral Iridotomies.

W. S. ATKINSON (*Am. J. Ophth.*, April, 1958) describes the technique of peripheral iridotomy which he uses without the aid of iris forceps or an assistant. The corneal flap is raised and the iris stroked gently down with the closed blades of the scissors. The ends of the scissors are then directed upward and backward towards the limbus. The end of one blade is pressed gently against the iris close to the upper lip of the wound and moved in the direction of the other blade parallel to the limbus. In this way a fold of iris is produced between the blades. The blades are closed, cutting the fold.

Cysts of the Iris.

P. A. CHANDLER AND H. BRACONIER (*Am. J. Ophth.*, April, 1958) report on four patients with multiple spontaneous intraepithelial cysts of the iris and ciliary body. In three patients acute glaucoma occurred due to closure of the angle from forward bulging of the periphery of the iris. In the fourth case there was excessive narrowing of the angle of one eye, but without raised tension. Gonioscopic examination is the most valuable diagnostic procedure; great variation in the width of the chamber angle is very suggestive of the presence of cysts.

British Medical Association.

SOUTH AUSTRALIAN BRANCH: SCIENTIFIC.

A MEETING of the South Australian Branch of the British Medical Association was held on November 28, 1957, at the Royal Adelaide Hospital. The meeting took the form of a symposium on the hazards of medical ionizing radiations, presented by the members of the staff of the radiotherapy department of the hospital.

The Hazards of Medical Ionizing Radiations.

The Nature of Ionizing Radiations.

MR. B. WORTHLEY, M.Sc., B.A., physicist to the radiotherapy department, discussed the nature of ionizing radiations. He said that ionizing radiations were those which electrified matter in their passage through it. That electricity arose from the planetary electrons surrounding the nucleus of each atom. The energy derived from the radiation detached electrons, which in turn detached further electrons from the atoms of surrounding material. The biological effect of ionizing radiation appeared to be closely correlated with the chemical changes produced in tissue by the introduction of those free electrical charges.

In South Australia, in the absence of nuclear reactors and particle accelerators such as cyclotrons, betatrons, etc., the only examples of ionizing radiation of practical interest were gamma, X and beta rays. The biological impact of X and gamma rays derived from their production of beta rays, so that the actions of the three types of rays were closely correlated. The sources of those rays might be divided into two, according to their mode of production. X rays were derived from diagnostic and therapy machines. Diagnostic X-ray machines generated X rays by the application of potentials in the range 50 to 130 kilovolts across the elements of an X-ray tube. Therapy machines operated in the range 10 to 4000 kilovolts in South Australia. Gamma and beta rays derived from radioactive material. The commonest materials for the production of gamma rays were radium, radon and Co^{60}. They were used in the treatment of malignant disease of the tongue, breast and uterus. Other materials in frequent use were I^{131}, used for the diagnosis and treatment of thyroid dysfunction, Au^{198} for recurrent pleural and peritoneal effusions, P^{32} for polycythæmia vera and Sr^{90} for the treatment of vernal conjunctivitis.

Mr. Worthley then said that it was imperative, for either the treatment of disease or the assessment of hazard, that units of dosage be devised and realized. The units used for ionizing radiations were largely based upon the electrification produced in a unit volume of air by their passage. That procedure gave rise to the old unit, the röntgen. The most recently authorized unit, the rad, was based upon the liberation of energy in unit mass of tissue. For soft tissue, as a broad approximation, the röntgen and the rad were largely equivalent. Doses producing skin erythema were of the order of 500 rads, whilst the doses aimed at in cancer therapy usually lay between 4000 and 8000 rads. At the other end of the scale were the so-called permissible doses for radiation workers. At present they had been set at 300 millirads per week, although that might be reduced to 30 millirads in the near future. Those figures might be compared with the two to three millirads received from natural sources, such as traces of radium in the soil and cosmic rays. From natural sources the whole of the population received approximately three rads in 30 years to the whole of the body. Some simple arithmetic might be of interest. On the assumption that one in every 1000 of the population was a radiation worker receiving the full permissible dose, between the ages of 20 and 40 years he would receive a dose of 300 rads or 100 times the natural dose. Dilution of that dose with the remaining 1000 of the population indicated only a 10% increase in average dose received per head. Practical measurement indicated that the increase was probably less than 1%. If every person in the whole population was exposed to radiographic procedures, then each would have to receive 100 millirads *per annum* to double the dose of radiation received by them from natural sources. In terms of possible dose received from X-ray investigations, that dose was quite small and could well be exceeded by investigations which encompassed the gonads (the organ of most interest in the present discussions) in the direct beam. The commonest X-ray examination was that of the chest. Gonadal doses from that source were less than one milliröntgen per film, so that such surveys did not present much genetic hazard. The study of gonadal doses from X-ray examinations was being carried out in various centres including the Royal Adelaide Hospital, so that the order of the average dose received by the population as a whole would soon be known with reasonable accuracy.

Mr. Worthley went on to say that the somatic effect of radiation lay not so much at the level of permissible doses which had obviously been chosen to give no general systemic effect, but at the level of dosage associated with the treatment of cancer. General body response to irradiation followed the so-called integral dose or total amount of energy absorbed by the whole of the body during a course of therapy. The integral dose was given by the dose in rads multiplied by the mass of tissue irradiated to that level, and the unit was the gramme rad. The distinction between dose and integral dose might be realized when it was appreciated that a dose of 400 rads might be given to a small area of the body with no apparent effect, but the same dose given to the whole body would kill in 50% of the cases. Therapy equipment was designed so that the integral dose received by the patient from stray radiation through the X-ray tube housing was less than that from the actual planned course of treatment. With small treatment areas, integral dose from the two sources might be largely identical. Usually, however, it was so small that no somatic effect was observed in that case. The problem of keeping gonadal doses low in patients undergoing a course of radiotherapy had not been widely faced at present. With a high proportion of cancer patients it was not thought to be important, for obvious reasons.

The measurement of radiation dose was usually achieved by the use of small ionization chambers, which usually consisted of an outer shell of plastic material encapsulating a small volume of air, and an inner electrode to collect the electrical charge freed by the passage of radiation. Frequently those were simple condensers charged to a few hundred volts. The passage of X rays partially discharged those condensers, and the change in potential, and therefore the dose in rads, was measured by the use of specially designed voltmeters capable of dealing with small amounts of electrical charge. Those chambers might be quite small, so that they might be comfortably inserted into body orifices to measure dosage. Another common method of measuring dosage, particularly in small amounts, was by using photographic film. Dental films, for example, usually showed measurable blackening upon development when subjected to radiation in the dose range five to 1000 millirads, and were extremely useful for staff protection work. Geiger counters were also used for measuring radiation at low intensity levels.

The principles of protection from ionizing radiation were simple. In dealing with beams of radiation, the three important factors were distance, time and material barriers. The intensity of radiation died away inversely as the square of the distance from the source, so that doubling the distance quartered the dose. In certain procedures, such as mounting radium tubes for use in treating carcinoma of the uterus, the hands were exposed. Such procedures had to be done as speedily as possible, to keep the time factor low. Barriers of material of high density, atomic number and thickness were usefully interposed between the body and the source of radiation. Such barriers came in the form of concrete walls, lead bricks, lead rubber aprons and gloves. In dealing with radioactive solutions, the problem of personal contamination arose. The wearing of gloves which might be washed or discarded was usually sufficient protection in such cases.

Mr. Worthley finally said that experience had shown that dosage received by the staff might be set in diagnostic and therapy departments to any level above that of the natural background and attainable by the simple procedures outlined. Certainly the permissible dose could be set to 30 millirads per week without hardship. When such simple methods failed, then other more complicated methods had been devised. They were extremely expensive. The decision which had to be faced was whether those responsible could afford not to spend the money.

The Harmful Somatic Effects of Ionizing Radiations.

DR. C. M. GURNER discussed the possible harmful somatic effects of alpha, beta, gamma and X rays, neutrons, protons, etc. He said that they were so extensive that he would speak in detail of a few of the more fashionable and controversial ones. The effects of natural background radiation from radioactive substances in the ground, cosmic rays and radon in the air were beyond human control, as also, he was afraid, were the effects of nuclear weapons. The rapidly expanding specialty of industrial medicine was helping to combat the occupational hazards of radioactive substances, and some thought was even being given to the prevention of the regrettably early deaths of a large proportion of

radiologists. That left for consideration the harmful somatic effects encountered in diagnostic and therapeutic radiology, and it had to be stressed that (*a*) those dangers were real, but (*b*) they could be minimized by understanding, training and skill.

Discussing diagnostic radiology, Dr. Gurner referred first to radiological pelvimetry and infantile leukæmia. He said that it had been shown beyond reasonable doubt that radiations might produce leukæmia, and that there was a higher incidence of leukæmia in children whose mothers had had X-ray pelvimetry performed during pregnancy than in children who had not thus been irradiated. However, that increased risk was still a small one, and was surely offset by the great reduction in fœtal and maternal mortality and morbidity brought about by that investigation. Moreover, careful case selection by the obstetrician, together with the use of high-voltage equipment, skilled radiography and a minimal number of films, should reduce the risk considerably. Professor L. J. Witts's figure of a possible 50 more cases of leukæmia a year compared favourably with 439 deaths of mothers in childbirth, 15,829 stillbirths, and 9750 deaths in the first week of life in England in 1955. Dr. Gurner further said that excessive fluoroscopy, in terms of either current or time, could produce severe damage to operator or patient, and some patients had needed months of skin grafting to repair burns following fluoroscopy by inadequately trained personnel. A skin dose up to 15*r* per minute was acceptable, but some poor techniques had been found to give up to 100*r* a minute of fluoroscopic screening.

Turning then to therapeutic radiology, Dr. Gurner first discussed radiotherapy in malignant disease, which aimed at cure or palliation of the disease by exploiting the difference in radiosensitivity between the malignant tissue and the surrounding healthy tissues. That difference was often slight, and in order to deliver a cancericidal dose to the tumour, it might be necessary to produce skin erythema and epidermolysis, disturbances of the gastro-intestinal tract, cystitis, leucopenia, etc. However, usually one could avoid the severe disturbances, and careful physical planning together with more modern equipment helped in that respect. One of the great advantages of supervoltage therapy, as with the linear accelerator, was the decreased risk of damage to skin, bone, cartilage and blood cells. Before such facilities were available, lung fibrosis following radiotherapy for carcinoma of the breast, and pathological fractures following deep X-ray treatment for uterine carcinoma, were not uncommon; but now they were seldom seen, and the incidence of other undesirable sequelæ had also decreased. Referring next to radiotherapy for benign diseases, Dr. Gurner said that leukæmia following radiotherapy for ankylosing spondylitis had also been widely publicized recently, and there was no doubt that the incidence of leukæmia in such cases was much higher than among patients not treated by radiotherapy (the incidence among treated patients was approximately 0·3%, ten times the normal); but the risk increased in direct proportion to the dose given, and also increased with the volume treated, so was usually associated with wide field, high dosage techniques. A long-term follow-up investigation of over 100 patients treated at the Royal Adelaide Hospital with small-dose, narrow-field techniques had shown no cases of leukæmia, but had shown a large number of patients who were grateful for the marked benefit they had obtained from radiotherapy. It seemed that in order to produce a significant rise in the incidence of leukæmia, one had to subject most of the hæmatopoietic bone marrow to a dose greater than was necessary to produce palliation of the spondylitis. Dr. Gurner went on to say that thymic enlargement had in the past been treated with small doses of X-ray therapy, often with gratifying results, but recently it had been demonstrated that amongst patients so treated in some overseas centres there had been a high incidence of juvenile thyroid carcinoma and other neoplasms. In all those cases, the doses used had been far greater than was the custom in Adelaide, where no such sequelæ had been seen; but the diagnosis of enlarged thymus as a cause of dyspnœa and the X-ray treatment of the gland had both decreased markedly in the last few years. Skin diseases often responded dramatically to small, safe doses of superficial X rays, but sometimes there were recurrences, and large doses or repeated courses, at times given unwittingly by different specialists in different buildings, streets or towns, might produce atrophy and even epitheliomata. Such skin changes were common in the earlier generations of radiologists.

Dr. Gurner, in conclusion, reiterated that there were harmful effects if ionizing radiations were used unwisely or unskilfully in diagnosis and therapy, but that knowledge and care prevented nearly all the harmful somatic effects, and that the clinician need not be denied those aids to diagnosis and treatment.

Genetic Considerations.

DR. F. A. DIBDEN discussed genetic considerations. He reminded those present that the human animal was composed of countless numbers of cells, each deriving originally from a single cell, the fertilized ovum, and differing in shape, size and function as a result of differentiation and specialization during the growth of the embryo. Each cell had a nucleus composed of 48 chromosomes (24 pairs), which in turn consisted of an unknown number of genes, and each cell had an identical gene and chromosome structure inherited from the parent sex cells. It was the nature and position of those genes on the chromosomes that determined the character of the individual, and although little was known of the nature of those genes, their number was certainly great—perhaps thousands or even tens of thousands per cell—so that the complexity of their arrangement was tremendous, and except for identical twins it was probable that no two individuals were exactly alike. Normally, in the process of cell division, each chromosome divided into two identical chromosomes, one going to each of the two daughter cells, so that the resultant cells had exactly the same chromosome and gene constitution as the parent cell. The genes, however, were not invariably stable, and occasionally one underwent a sudden change and was converted into a slightly different form. If that cell then subsequently divided, the altered gene also divided and was passed on to the daughter cells, and with each subsequent division was reproduced just as faithfully as was the original gene. That alteration in the gene was called mutation, and the effect of such mutation depended on the nature of the change and on the specific gene affected. Some mutations were beneficial to the organism and others were detrimental, while in between lay a whole range of effect. The causes of mutation were not definitely known; but some occurred by chance disturbance of the complex molecules comprising the genes, while others resulted from external stimuli such as certain chemicals and natural background radiation. As far as was known, all genes were subject to mutation. That was continually occurring over the population as a whole at a definite but very low rate, and it was believed that any factor which influenced mutation, influenced only the rate of change and did not produce new mutations.

Dr. Dibden went on to say that in the evolution of man, the effect of such mutations had been modified by natural selection; an advantageous mutation assisted its possessor in adapting himself to his environment and so was perpetuated, while a harmful mutation was slowly eliminated. However, mutations were continually occurring, and so a state of equilibrium was reached at which the removal of harmful mutations was balanced by new formation. As advantageous mutations produced effects tending towards perpetuation of the characteristic, it was apparent that such mutations as had occurred in the past would be widespread throughout the population, and so any increase in their rate of production would have little appreciable effect. On the other hand, harmful mutations had been restricted to low incidence by natural selection, and hence any increase in their rate of production would have a much more appreciable effect. It might thus be concluded that increasing the mutation rate in a human population would have a relatively much greater effect on the incidence of harmful than of harmless or advantageous hereditary traits.

Dr. Dibden then said that in considering the genetic effects of ionizing radiation, three factors stood out in importance: first, the age and reproductive potential of the individual; secondly, the type of change produced; thirdly, the rate at which such change occurred. It was apparent that any change in the germ cells of an individual would have no effect on that particular individual, but only on the offspring of that individual or their descendants. Therefore, should the change occur in a person past the reproductive age, or should that person not leave offspring, then such change as might occur would die out, and no genetic effect would be produced within the population. Dr. Dibden then referred to the type of change produced in germ cells or cells ancestral to them. He said that one of three things might occur as a result of irradiation—the cells might die, there might be chromosome breaks or there might be gene mutation. In the first case, when the cells died, no reproduction could take place and thus there was no effect. With chromosome breaks, normal division might be impossible, so that the line died out before reaching maturity, or if it occurred in a mature cell subsequently fertilized, the ensuing embryo would usually die early in gestation. How-

ever, should the chromosome breaks reunite in new patterns which were capable of passing through cell division, the resultant changed chromosomes might be transmitted to apparently normal offspring and manifest themselves in subsequent generations. However, experiments on mammals indicated that such changes were induced mainly by single large doses of radiation and only rarely by long-continued exposure to small doses, and then only if conception occurred within a few months of irradiation, so that all in all chromosome damage was likely to have little genetic effect. Gene mutation, however, being a natural phenomenon, was a much more important factor. Experiments on *Drosophila* and other organisms indicated that there was no known threshold for the induction of gene mutations by radiation, so that any additional exposure, no matter how small, must be expected to raise the mutation rate even if by only a minute amount, while it also appeared that the increase in the rate was directly proportional to the amount of additional exposure. Another factor of considerable importance was that, in contrast to most other types of biological response to radiation, damage to genetic material could not be repaired, and thus the effect of repeated exposures was cumulative. Mature germ cells were produced from a line of ancestral cells which had been present throughout the whole of the individual's life, and as mutated genes reproduced themselves as faithfully as did the normal genes, it was apparent that mutated genes occurring throughout a germ-cell lineage would be accumulated in the mature germ cell, and a given radiation dose would have the same ultimate effect whether received in a long or a short time. Turning to the rate of mutation, Dr. Dibden said that there they were on very uncertain ground. Much experimental work had been done on the fruit fly, *Drosophila*, and on small mammals, but the results so far were far from complete, while there was considerable objection to transposing such results to human beings. Further information had been obtained from a study of those diseases which were believed to be due to a single gene—namely, achondroplasia, hæmophilia and phenylketonuria—together with the incidence of mental defects, but even so, knowledge was very fragmentary. Then again, the fraction of the mutation rate which was attributed to ionizing radiations was also unknown, but from the above-mentioned experiments, it had been estimated to be between 2% and 20%. Again, there was considerable doubt that all genes were equally radiosensitive, so that an increase in the amount of radiation received by the gonads might have different effects on different genes.

When gene mutation by radiation was being considered, the yardstick usually employed was the "doubling dose"—the dose required to double the natural mutation rate. It had been calculated that the dose received by the gonads from natural sources in a space of 30 years amounted to about 3*r*, so that if the fraction of mutations due to radiation was between 2% and 20%, the dose required to double that rate would be between 15*r* and 150*r*. However, other evidence would tend to limit that range somewhat, and the best estimate that could be made at present was that the doubling dose lay between 30*r* and 80*r*. Then again, when that doubling dose was studied, they had to consider whether it was doubled for one generation only and then reverted to normal, or whether it remained permanently doubled. The difference might be well illustrated by those diseases previously mentioned. Achondroplasia was considered to be due to a dominant mutation, and a doubling of the dose for one generation only would cause an immediate increase in its occurrence of about 80%, but it would revert to normal figures in five or six generations. If the dose remained doubled, however, the increase would rise to almost 100% in three or four generations. Hæmophilia was a sex-linked mutation, and a doubling dose for one generation would cause a 30% increase with a quick return to normal, while permanent doubling would lead to a 90% increase in six generations and then a slow further increase to 100%. Phenylketonuria, which was due to a recessive mutation, showed only a 1% increase in the next generation and then reversion to normal with a single doubling dose, while with permanent doubling of the dose the increase would be steady but slow, and it would take more than 50 generations to produce a 50% increase. Thus it could be seen that the effects produced by increasing the mutation rate differed greatly according to the genes affected, whether dominant, sex-linked or recessive, and on the duration of the factors producing such increase.

Dr. Dibden next considered the sources of radiation and the doses likely to be received by a civilized population in the world at the present time. He said that natural background radiation, resulting from cosmic rays and naturally occurring radioactive elements, was unavoidable, and as he had mentioned before, amounted to about 3*r* in 30 years. Apart from that, the greatest source of radiation to the gonads came from diagnostic radiology. From a careful investigation in England it had been found that almost the whole population was at risk from diagnostic radiology, but that almost the whole of the population dose to the gonads resulted from a relatively few sites of examination, principally the hip, the lumbar part of the spine, the lower part of the abdomen and the pelvis. The far more frequent examinations, such as chest, head and limbs, made relatively little contribution. The dose thus received, also over 30 years, had been estimated by the use of careful measurements made during actual diagnostic examinations, to be about 22% of that received from natural sources, although the figure might actually be higher, as in the measurements minimum values were taken. It could thus be seen that radiology produced an appreciable increase in the radiation dose received by the gonads, and as its application had been steadily increasing, it was as well to pause and reflect on its possible consequences. However, he did not think there should be undue pessimism or alarm. Even if the dose received was taken to be twice that estimated, or about 50% of the background dose, that amounted to about 1·5*r*, which was only 5% of the doubling dose if that was taken to be the lower limit of the range previously mentioned—namely, 30*r*. The effect therefore was not likely to be great, but there would be some effect, and it was therefore incumbent on all to restrict such examinations on people within the reproductive or pre-reproductive age groups to an essential minimum. With radiotherapy, including the use of isotopes such as I^{131}, although its main application was for the treatment of malignant disease in the older age groups in which gene mutation was no problem, it was also used for some conditions in younger people—for example, ankylosing spondylitis and various skin conditions—in whom there could be some effect. The actual doses from that source had not been estimated as yet, although they were certainly much less than from radiodiagnosis, but the same restrictions should apply. Other sources of radiation were X-ray machines for shoe fitting, luminous watches and clocks and television sets, and in England those together probably delivered less than 2% of the natural background dose to the gonads—a small amount, certainly, but still an additional dose. In the present atomic era, the testing of nuclear weapons had introduced a further source of radiation from contamination from fall-out, and had received much publicity. However, a close watch had been kept on that by the English authorities, and at present it did not really constitute much of a hazard. It has been estimated that if the present rate of testing continued, the activity would slowly build up, rising to a plateau in about 100 years, and the population over a 30-year period would receive only about 1% of the dose that would be received from natural sources. Of course, if the testing should increase appreciably, and especially if thermo-nuclear weapons were used, the hazard could become much greater, while if there was an atomic war the dangers would be enormous, and every population throughout the world would suffer.

Dr. Dibden finally said that so far he had been speaking generally on the population as a whole. He wished, in conclusion, to consider the individual briefly. What could be expected if a person received a doubling dose and subsequently had children? At present the chance of producing a stillborn child, a congenitally defective child or a child who subsequently became defective, was 7% or 8%. Doubling the mutation rate would increase that chance by only about 0·1%. Then again, if an individual had a big dose, the chance that his children would inherit a particular gene was one in two, his grandchildren one in four, his great grandchildren one in eight, and so on. Thus, if the increased dose was not perpetuated, the chance that any effect would be produced was reduced as time went on, and so there was little likelihood of that particular individual's founding a "bad line" of descendants.

Summary.

DR. B. S. HANSON, in summarizing the discussion, said that for over half a century it had been well known that ionizing radiations might cause serious ill effects, and in 1928 a committee in Great Britain had drawn up the first recommendations for radiological protection which later were adopted as international recommendations. At that time the anxiety was mainly that workers with those rays should receive adequate protection, as it was not then realized that the irradiation received by the patients could be harmful except by producing necrosis when local overdosage was given. For some years now radiologists had been

well aware that patients also needed protection, and in the radiotherapy of young people, for example, efforts had been made to avoid direct irradiation of the gonads when their presence within the field of treatment was not really necessary. Recently it had become known that even tiny doses could have an adverse cumulative effect, as had been made clear in the earlier part of the discussion. It was, however, unfortunate that that information had been seized upon by the Press as a matter of public interest, and had been publicly discussed, and perhaps even magnified by some members of scientific professions, so that the general public had been bombarded with information both true and false, but was unhappily in no position to exercise any sort of judgement on the matter. It was not to be wondered at that some reactions had been almost in the "panic" class, and likely to bring in their train health troubles far more certainly than the rather theoretical risks of radiations which they were designed to avert.

Dr. Hanson went on to say that the possible disadvantages of ionizing rays had been recognized as a public health measure by governments, so that in most Australian States there had been set up a Radiological Advisory Committee including public health administrators, physicists and men practising radiotherapy and radiodiagnosis, while there were two committees of the National Health and Medical Research Council, the Radiotherapy Advisory Committee and the Radiation Hazards Advisory Committee, both of which would give technical advice to the committee set up by the Commonwealth Government under the chairmanship of Sir Macfarlane Burnet. There were obviously some public health measures which could be carried out by committees of that type, for regulations would deal with the construction of irradiating apparatus, the disposal of radioactive material, the quality of buildings to house such materials, and so on. Some uses of ionizing radiations would almost certainly be forbidden—such, for example, as the use of X-ray machines to assist in the sale of footwear; they certainly gave a very small exposure to the gonads, but it was an exposure which was quite unjustified under any regard except that of increasing sales. However, the greatest assistance in keeping down the level of artificial irradiation in the population at large would come from that section of the population which by its training was best able to assess the requirements and the risks—the medical profession. As had been noted previously, it was a little unfortunate for the public that the recent alarms about radiation dangers had not been fully sifted out by that profession before extensive advertisement of them was made in the daily Press. Those present at the symposium should look at the practical implications of this recent knowledge, the alleged dangers of nuclear explosions and the threat of nuclear war having been merely mentioned in passing as causing some increase, however small, in the background irradiation to which everyone was subjected. It was of interest that the alleged world-wide dangers of nuclear explosions probably gave rise to comparison with total population effects of so common a thing as medical radiography, and thus by chance drew attention to the fact that there were dangers inherent in this as well.

Dr. Hanson then said that it was obviously desirable to decrease the medical dose of ionizing rays received by the community without at the same time impairing the great value of those rays. There had been calls to stop the case-finding surveys of the tuberculosis services, and it seemed that at one Sydney obstetrics hospital the routine radiographic examination of the chests of women newly admitted had been discontinued. It was his feeling that the present generation should not be sacrificed for a somewhat theoretical risk to future generations, that tuberculosis was a more real threat than adverse mutations, and that what was required was a more careful and informed use of X rays, rather than their complete rejection. It was interesting in that regard that an investigation proceeding at the Royal Adelaide Hospital showed that routine radiographic examination of the lungs gave a dose to the gonads so small that it could not be really measured; it was certainly less than one milliröntgen per film exposed. Similarly there had been people who had declined to use X-ray therapy in the treatment of ankylosing spondylitis because of the alleged danger of the subsequent development of leukæmia. There were risks, as those present had heard, for they accepted without hesitation the findings of the Medical Research Council's Committee in that regard. But the percentage of their patients who developed that complication was very small, and a survey of the 103 patients treated for ankylosing spondylitis in the radiotherapy department of the Royal Adelaide Hospital, with a wide range of dosage levels, had not revealed one who had developed leukæmia. Apart from deep X-ray therapy, it was probable that cortisone had offered the best chance of relief in that potentially crippling disease; it was held that the risks of complications from cortisone treatment were materially greater than the risk of leukæmia, and that so long as good evidence for diagnosis of that disease was demanded, particularly in young women, deep X-ray therapy might well still be the treatment of choice. It was claimed that the desirability of any radiological examination or treatment should be assessed in some such way, and that it should be based on judgement as far as present knowledge allowed rather than an emotion.

Dr. Hanson then said that the possibility of decreasing unnecessary exposure might be examined under various heads. First, there were certain mechanical requirements which the State must soon demand. At present there were no restrictions on the amount of X rays which might pass out of a tube housing beyond the limits of the useful beam, although there were international recommendations which limited the emission of stray radiations from beam-therapy units; obviously minimum standards would have to be set up in that regard, and the machines would have to be properly maintained. The useful beam itself should be confined to the smallest limits necessary for the proper exposure of the part under examination. Beam-defining cones commonly used had a circular cross-section, and either exposed only part of a rectangular film, or necessarily permitted useless exposure of tissue beyond the limits of the film; they would have to be replaced by relatively costly multi-leaf collimators which might be adjusted to any useful rectangular size, and it had been suggested that it should be required of a radiographer that his film should show a small unexposed margin to prove that the X-ray beam was properly collimated. Image intensification by electronic means, permitting screen examination with very small currents, had to a large extent passed beyond the research stage; but the five-inch maximum field of one well-known make and the cost of some £2000 made them a little unpractical at present; they had to be developed until photography of the image produced by tiny exposures would record detail at least as good as could be obtained by present radiographic techniques. The use of higher voltages for radiography, perhaps 120 or 130 kilovolts, significantly lowered the absorbed dose, and that should become routine for examination of the female pelvis and would involve increased cost of X-ray plants. Certain other less costly apparatus might also be required, such as shaped metal shields to protect the gonads when other protection was not practicable, and lead or lead-rubber adjustable screens for a similar purpose. Once it had been arranged that proper apparatus would be provided, the next step was undoubtedly a critical assessment of each examination required. In that regard, when a thorough clinical examination would elicit the necessary information an X-ray test was superfluous and therefore unjustified. It should be remembered that the adverse effect of ionizing rays increased sharply with the youth of the subject, and therefore particular care should be taken in deciding to examine by X rays a child or an infant. Too often, for example, did one see a request for pelvimetric examination of a pregnant woman who had previously been delivered of a child by natural means, surely the greatest test of adequacy of the birth passage. The subject was too wide for full discussion at the present meeting, and all that needed to be done was to draw attention to the fact that an ethical principle was concerned, whilst it was stressed that a properly carried out radiographic examination should never be denied a patient for whom results of material benefit were possibly to be obtained. When referred to a specialist radiologist, the patient was likely to have the technical procedures carried out by a qualified technician. Additional training would in future be required of a technician, so that he would produce not only a good picture, but a good picture with the least possible exposure of the patient to ionizing rays. Second exposures because of errors in the first exposures would be required only if the radiographer was second grade. Human nature being what it was, some regular check of technical procedures should be made by the radiologist, either by watching a proportion of examinations performed, or by insisting that the limits of the collimating cone be shown on each film. In that regard the "occasional" radiologist who carried out his own technical procedures was likely to show up rather badly. That a general practitioner needed a plant for X-ray examination of his fracture patients was agreed, but because he used it infrequently, it was likely to be of a substandard type. In the absence of a range of cones, X-ray examination of a limb or of the chest, for example, might well include the gonads in the primary beam, while repeat examinations because of technical errors would be relatively common. In one Australian State there was an outcry because the public health authorities proposed that

all users of irradiating apparatus should be licensed. Dr. Hanson said it was his opinion that the present undergraduate education was not designed to, and in fact did not, qualify the graduate to practise general radiology, and that either only the simplest radiographic procedures should be carried out by such a graduate, using an approved apparatus, or else undergraduate training should be widened to include the necessary training; that he believed to be impracticable.

Dr. Hanson then said that in so far as radiotherapy dealt with cancer, there could be little question about its use in a suitable case. In a proportion of cases, tissue damage in the form of necrosis should be accepted, for doses often had to be carried right up to tissue tolerance, and as Ralston Paterson had pointed out, the radiotherapist who never caused necrosis probably did not cure as high a proportion of his patients as he should. It was in the realm of benign conditions that second thoughts may be warranted, and in that regard Dr. J. H. Martin in Melbourne had noted that, of patients treated in his institution for benign conditions, nearly one-third were under the age of 21 years. Dr. Hanson believed that the low doses, the small fields and the poorly penetrating rays usually needed for such treatments made for safety, but that radiotherapy for benign conditions should not be lightly given to people under the age of 35 years, and particularly to infants. The use of radioactive isotopes in the diagnosis and treatment of benign conditions was so limited that those materials did not constitute a measurable risk to the general population. The low penetration of beta rays practically obviated a genetic risk in the doses commonly employed. Radioiodine was an efficient treatment for thyrotoxicosis; but as cancer of the thyroid had, after a latent interval, been induced in rats by doses of radioiodine comparable to those used in the treatment of human thyrotoxicosis, it was prudent to reserve that treatment for people over the age of 45 years unless there were contraindications to surgical treatment. In the 13 years which had elapsed since radioactive isotope treatment of the thyroid was introduced, there had been no recorded case in which the development of cancer might reasonably be attributed to the treatment, but that time interval might well be too short for valid conclusions to be drawn.

In conclusion, Dr. Hanson said he believed that the community risks of radiotherapy were negligible. The risks of radiography were more real, but the policy of discontinuing that form of examination would involve risks far greater. There were much more serious dangers in driving on public roads, but the answer was not to prohibit the use of motor vehicles. So, with radiology, the answer was more efficient apparatus efficiently handled. The costs, already high, might go higher, but that was an expense which they could not afford to omit.

Out of the Past.

In this column will be published from time to time extracts, taken from medical journals, newspapers, official and historical records, diaries and so on, dealing with events connected with the early medical history of Australia.

INAUGURATION OF THE QUEENSLAND BRANCH OF THE BRITISH MEDICAL ASSOCIATION.[1]

[From the *Australasian Medical Gazette*, July 25, 1894.]

A MEETING to celebrate the inauguration of the Queensland Branch of the British Medical Association was held in Brisbane on May 30, 1894. The Hon. W. F. Taylor, M.D., M.L.C., occupied the chair, and was supported by His Excellency Sir Henry Wylie Norman, G.C.B., Q.C., the Hon. A. C. Gregory, M.L.C., President of the Australian Association for the Advancement of Science, the Hon. A. S. Cowley, Speaker, Major General Owen, Rev. G. D. Buchanan, and Mr. Drew, Chairman of the Civil Service Board. There was a large and representative gathering of medical men, and of scientific and political gentlemen.

The President delivered a short address, explaining the objects of the British Medical Association, and giving a short account of its formation and growth, and of the formation of the Queensland Branch.

He urged upon the members the continuous effort to advance the cause of medical science, and especially emphasized the need of a more careful consideration of the question of the contagiousness of phthisis.

The usual loyal toasts were enthusiastically pledged. The President proposed "His Excellency the Governor". His Excellency replied.

Dr. Lyons proposed "The Ministry and Parliament of Queensland", which was responded to by the Hon. T. Macdonald Paterson, M.L.C., on behalf of the Legislative Council and by Mr. Kingsbury for the Legislative Assembly.

His Excellency the Governor proposed "The Queensland Branch of the British Medical Association".

An ode specially written for the occasion by Mr. J. Brunton Stephens, and set to music by Professor Allen, was then sung.

Dr. E. S. Jackson, Treasurer of the Branch, replied to the toast. He mentioned as matters requiring the immediate attention of the Branch the necessity for urging the establishment of an inebriate asylum, also the want of a hospital beyond the coast range for the treatment of consumptives, and the necessity for an Inspector of Charities.

Dr. Connolly proposed "Kindred Societies", which was responded to by the Hon. A. C. Gregory, C.M.G. Dr. E. O'Doherty proposed "The Press", and Mr. J. W. Brookes replied.

During the evening a musical programme was very ably sustained under the direction of Professor Allen.

[1] From the original in the Mitchell Library, Sydney.

Correspondence.

"ETHICAL" LITERATURE.

SIR: Yesterday I received, by post, an envelope marked "Personal", which, when opened, contained only a printed price list, blotting paper, etc., from a certain drug firm. I will not, in future, prescribe any of the drugs in their price list, and I suggest that all readers of your Journal should take the same action against drug firms which adopt such unethical methods of forcing their attention on doctors.

Yours, etc.,

V. L. MATCHETT.

51 Wickham Terrace,
Brisbane,
July 18, 1958.

AN UNUSUAL DERMATITIS.

SIR: Dermatologists would agree with Dr. Rathus and Mr. Brindlecombe (M. J. AUSTRALIA, July 5, 1958) that *Pediculoides ventricosus* causes an unusual dermatitis, but would add that it is rare in miners. Many miners' dermatoses are treated in this area where there are approximately ten thousand miners. The figures for 1956-1957 for those claiming compensation for skin diseases were: "tinea", 21; "boils", 153; "dermatoses", 70. Only twice during the last ten years has the diagnosis of "bites" been confirmed. In the northern district miners considered "borer bites" to be a common cause of dermatitis, until investigations were carried out in 1950. As a result of this the following report was sent to the Coal Mines Insurance:

> Pediculoides Ventricosus is the causative agent of "grain or straw itch". The mite may be parasitic on the powder borer beetle and may attack man. However, generally speaking on the balance of probabilities cases of "Acarine" dermatitis must be rare. They require for their occurrence that there shall be pit props heavily infected with powder borer beetles. These borers must themselves be infested with pediculoides ventricosus and the mites must for some reason have left the borers and become predacious towards man. They do not burrow into the human skin, but produce wheals with a central pinpoint vesicle which later becomes pustular. The appearance is characteristic. The trunk is most frequently affected, the appendages being much less involved. A few scattered lesions may appear on the face. A variant of the eruption occurs as slightly raised erythemato-urticarial areas. The mites may originally have been introduced to the mines on hay being taken in for the pit ponies.

Again in 1958 a further investigation was carried out and an insect other than a borer was sent to the Australian

Museum for recognition. The following report was received from the curator of entomology:

> The beetle proved to be the *Stigmatium* (*Stigmatium*) *gilberti* White, a member of the family Cleridæ which includes a large number of species in Australia. These beetles are predacious upon other insects or their larvæ. Some of the larger species are capable of inflicting sharp nips with their jaws. We rarely hear, however, of these beetles occurring in such numbers as to be a nuisance.

In conclusion, may we state that the lesion is characteristic, consisting of weals with a central pinpoint vesicle. The mite usually crawls under the clothing and bites the more tender parts of the body: the abdomen, the back and sides, and seldom the skin of exposed parts. As usual, it is the active female that attacks man.

Yours, etc.,

W. W. GUNTHER,
W. H. WARD.

17 Bolton Street,
Newcastle,
New South Wales.
July 16, 1958.

Post-Graduate Work.

THE POST-GRADUATE COMMITTEE IN MEDICINE IN THE UNIVERSITY OF ADELAIDE.

PROGRAMME FOR JULY AND AUGUST.

Overseas Lecturers.

PROFESSOR MAXWELL WINTROBE, Professor of Internal Medicine, University of Utah, through the generosity of Pfizer Limited, will be visiting Adelaide from July 27 till August 3. The following lectures have been arranged, to which all members of the medical profession are invited:

Tuesday, July 29, at 8.30 a.m. in the Verco Theatre: "Blood Formation, Blood Destruction, the Spleen and Splenectomy."

Thursday, July 31, at 2.30 p.m. in the Department of Medicine: "Blood Disorders Caused by Drug Sensitivity."

Friday, August 1, at 8.30 p.m. in the Verco Theatre, at a meeting of The Royal Australasian College of Physicians: "Factors Concerned in Erythropoiesis" and "Search for an Experimental Counterpart of Pernicious Anæmia".

Dr. M. D. Milne, M.D., M.R.C.P., Lecturer in Medicine, Post-Graduate Medical School, London, will be in Adelaide from August 5 till August 12. The programme for Dr. Milne's visit is as follows, and all members of the medical profession are invited to attend.

Wednesday, August 6, at 4.30 p.m.: Medical ward round at the Royal Adelaide Hospital.

Thursday, August 7, at 8.30 p.m. in the Verco Theatre: "Metabolic Disease of Bone."

Monday, August 11, at 8.30 p.m. in the Verco Theatre, at a meeting of The Royal Australasian College of Physicians: "Potassium Metabolism."

Tuesday, August 12, at 1 p.m. in the Department of Medicine: Lunch-time clinical meeting.

Dr. M. H. Draper, M.B., B.S., Ph.D. (Adelaide and Cambridge), Senior Lecturer in Physiology, University of Edinburgh, is visiting Australia as Carnegie Fellow. Dr. Draper will deliver the following lecture:

Thursday, August 21, at 8.30 p.m. in the Verco Theatre: "The Clinical Interpretation of the Electrocardiograph as Revealed by Intracellular Microelectrode Studies."

Post-Graduate Medical Ward Rounds.

The second series of special post-graduate medical ward rounds for 1958 will begin on Wednesday, August 6. Dr. M. D. Milne will conduct the first ward round at 4.30 p.m. For practitioners who have not already enrolled the fee for this course will be £3 3s.

Country Courses.

Gladstone.—On Sunday, August 3, at 2 p.m. in the Gladstone Institute: "Common Nose and Throat Problems", Dr. R. N. Reilly; "Painful Conditions of the Feet", Mr. J. R. Barbour.

DISEASES NOTIFIED IN EACH STATE AND TERRITORY OF AUSTRALIA FOR THE WEEK ENDED JULY 12, 1958.[1]

Disease.	New South Wales.	Victoria.	Queensland.	South Australia.	Western Australia.	Tasmania.	Northern Territory.	Australian Capital Territory.	Australia.
Acute Rheumatism	2(1)	4(3)	2	..	4(3)	..	..	..	12
Amœbiasis	..	..	..	..	..	..	..	..	..
Ancylostomiasis	..	..	..	..	..	..	3	..	3
Anthrax	..	..	..	..	..	..	..	..	..
Bilharziasis	..	..	..	..	..	..	..	..	..
Brucellosis	..	..	..	..	..	1	..	..	1
Cholera	..	..	..	..	..	..	..	..	..
Chorea (St. Vitus)	..	..	..	..	..	..	..	..	..
Dengue	..	..	..	..	..	..	..	..	..
Diarrhœa (Infantile)	..	16(14)	1	3	..	..	..	2	22
Diphtheria	2	..	..	..	1(1)	..	..	..	3
Dysentery (Bacillary)	..	4(1)	..	1(1)	4(4)	..	..	..	9
Encephalitis	..	..	..	1(1)	..	..	..	..	1
Filariasis	..	..	..	..	..	..	..	..	..
Homologous Serum Jaundice	..	..	..	..	..	..	..	..	..
Hydatid	..	1	..	..	..	..	..	..	1
Infective Hepatitis	49(20)	13(7)	6	4(2)	4(4)	..	1	2	79
Lead Poisoning	..	..	..	..	..	..	..	..	..
Leprosy	..	..	..	..	5	..	1	..	6
Leptospirosis	..	..	4	..	..	..	..	..	4
Malaria	..	..	..	..	..	..	..	..	..
Meningococcal Infection	1	1	..	..	..	..	..	..	2
Ophthalmia	..	..	..	..	..	..	..	..	..
Ornithosis	..	..	..	..	..	..	..	..	..
Paratyphoid	..	..	..	..	..	..	..	..	..
Plague	..	..	..	..	..	..	..	..	..
Poliomyelitis	1	1(1)	..	..	..	..	..	..	2
Puerperal Fever	..	..	..	..	..	..	..	..	..
Rubella	..	18(14)	..	3(3)	38(36)	1(1)	..	..	60
Salmonella Infection	..	..	..	1(1)	..	..	..	..	1
Scarlet Fever	19(6)	15(9)	2(1)	7(6)	5(3)	2	..	..	50
Smallpox	..	..	..	..	..	..	..	..	..
Tetanus	..	..	1	..	..	..	..	..	1
Trachoma	..	..	..	..	..	..	7	..	7
Trichinosis	..	..	..	..	..	..	..	..	..
Tuberculosis	27(9)	11(7)	11(5)	4(4)	5(3)	4(1)	..	..	62
Typhoid Fever	..	..	..	..	..	..	..	..	..
Typhus (Flea-, Mite- and Tick-borne)	..	..	..	..	..	..	..	..	..
Typhus (Louse-borne)	..	..	..	..	..	..	..	..	..
Yellow Fever	..	..	..	..	..	..	..	..	..

[1] Figures in parentheses are those for the metropolitan area.

Barmera.—On Saturday and Sunday, August 2 and 3: "Menstrual Irregularities and Prolonged Labour", Dr. H. E. Pellew; "Some Aspects in the Management of Renal Colic", Mr. John Maddern; "Chronic Pancreatitis", Dr. Robert Hecker.

Pædiatric Refresher Week.

Through the courtesy of the honorary staff of the Adelaide Children's Hospital, a refresher week in pædiatrics will be held from August 25 to 29. The fee for this course will be £5 5s. (full time) and £2 12s. 6d. (half-time). Application should be made to the Secretary, The Post-Graduate Committee in Medicine.

Swift Memorial Lectures.

Dr. Howard Williams, M.D., M.R.A.C.P., honorary physician, Royal Children's Hospital, Melbourne, will visit Adelaide to deliver the Swift Memorial Lectures in 1958 and take part in the pædiatric refresher week at the Adelaide Children's Hospital. The subjects of his lectures will be as follows:

Tuesday, August 26, at 8.30 p.m. in the Verco Theatre: "Bronchiectasis in Childhood."

Thursday, August 28, at 8.30 p.m. in the Verco Theatre: "Failure to Thrive in Infancy."

THE POST-GRADUATE COMMITTEE IN MEDICINE IN THE UNIVERSITY OF SYDNEY.

Post-Graduate Conference at Newcastle.

THE Post-Graduate Committee in Medicine, in conjunction with the Central Northern Medical Association, will hold a week-end conference in the lecture theatre, Royal Newcastle Hospital, on Saturday and Sunday, August 16 and 17, 1958. This programme will cover the Section on Medicine and is as follows:

Saturday, August 16: 2.30 p.m., registration; 2.45 p.m., "Thyroid Diseases in General Practice", Dr. Peter F. Hall; 4.30 p.m., "Aspects of Cerebral Vascular Diseases", Dr. George Selby.

Sunday, August 17: 10 a.m., "Endocrinopathies in General Practice", Dr. Keith S. Harrison; 11.30 a.m., "Recent Advances in the Treatment of Parkinson's Disease", Dr. George Selby.

The third Post-Graduate Conference at Newcastle on the Section of Surgery will be held on October 22 and 23, 1958.

The combined fee for attendance will be £3 3s., or £1 1s. for each section, and those wishing to attend are requested to notify Dr. H. N. Rose, Honorary Secretary, Central Northern Medical Association, 581 Glebe Road, Adamstown, as soon as possible. Telephone: LU 1047 (Newcastle).

The Royal Australasian College of Physicians.

APPLICATIONS FOR RESEARCH GRANTS.

APPLICATIONS for grants for medical research for the year commencing January 1, 1959, will be considered by the Research Advisory Committee of The Royal Australasian College of Physicians in September next, and grants will be made by the Council at its meeting in October.

Information regarding the conditions of award of research grants or grants-in-aid is available on application to the honorary secretary of the College, The Royal Australasian College of Physicians, 145 Macquarie Street, Sydney. The closing date for the receipt of applications will be Monday, September 1, 1958.

Nominations and Elections.

THE undermentioned have applied for election as members of the New South Wales Branch of the British Medical Association:

Jamieson, Walter Connal, M.B., B.S., 1955 (Univ. Sydney), 8 Smith Avenue, Hurlstone Park, New South Wales.

Babicka, Alois, M.D., 1946 (Univ. Prague) (registered in accordance with the provisions of Section 17 (2b) of the *Medical Practitioners Act*, 1938-1958), Royal South Sydney Hospital, Zetland, New South Wales.

Deaths.

THE following deaths have been announced:

PUNCH.—Francis Michael Greenway Punch, on July 18, 1958, at Rose Bay, New South Wales.

GARVICE.—Martha Isabel Garvice, on July 23, 1958.

Diary for the Month.

AUG. 5.—New South Wales Branch, B.M.A.: Organization and Science Committee.
AUG. 6.—Victorian Branch, B.M.A.: Branch Meeting.
AUG. 6.—Western Australian Branch, B.M.A.: Branch Council.
AUG. 7.—South Australian Branch, B.M.A.: Council Meeting.
AUG. 8.—Queensland Branch, B.M.A.: Council Meeting.
AUG. 8.—Tasmanian Branch, B.M.A.: Branch Council.
AUG. 12.—New South Wales Branch, B.M.A.: Executive and Finance Committee.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Medical Secretary, 135 Macquarie Street, Sydney): All contract practice appointments in New South Wales. Anti-Tuberculosis Association of New South Wales. The Maitland Hospital.

South Australian Branch (Honorary Secretary, 80 Brougham Place, North Adelaide): All contract practice appointments in South Australia.

Editorial Notices.

ALL articles submitted for publication in this Journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given: surname of author, initials of author, year, full title of article, name of journal, volume, number of first page of the article. The abbreviations used for the titles of journals are those adopted by the Quarterly Cumulative Index Medicus. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors submitting illustrations are asked, if possible, to provide the originals (not photographic copies) of line drawings, graphs and diagrams, and prints from the original negatives of photomicrographs. Authors who are not accustomed to preparing drawings or photographic prints for reproduction are invited to seek the advice of the Editor.

Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary is stated.

All communications should be addressed to the Editor, THE MEDICAL JOURNAL OF AUSTRALIA, The Printing House, Seamer Street, Glebe, New South Wales. (Telephones: MW 2651-2-3.)

Members and subscribers are requested to notify the Manager, THE MEDICAL JOURNAL OF AUSTRALIA, Seamer Street, Glebe, New South Wales, without delay, of any irregularity in the delivery of this Journal. The management cannot accept any responsibility or recognize any claim arising out of non-receipt of journals unless such notification is received within one month.

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